Effects-based Operations: An Overview

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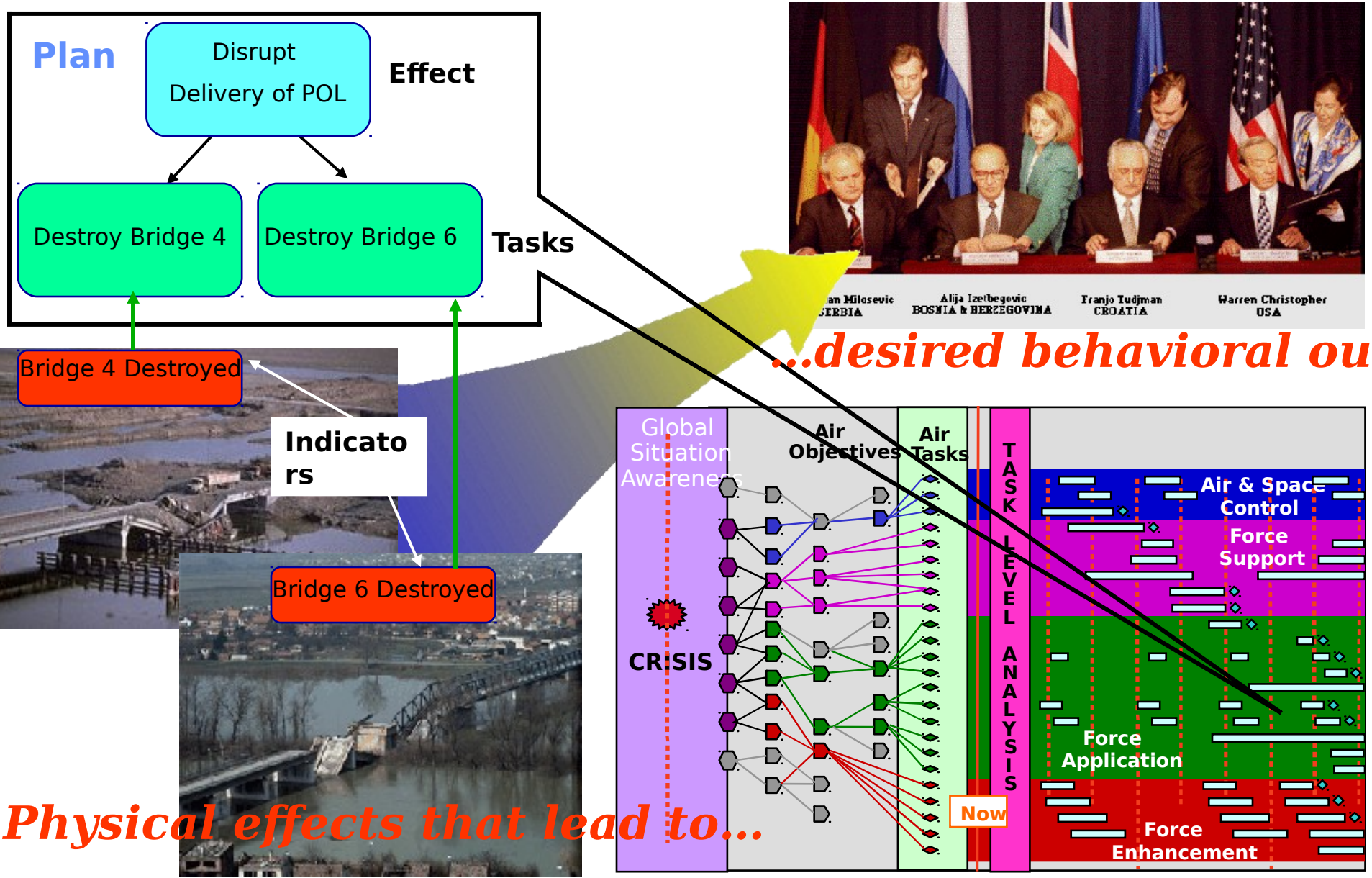
Overview

- Introduction
- Definitions
- Models
- ATD Technologies
- EBO in Operation ALLIED FORCE

Effects-Based Operations



Effects-Based Operations

"Effects based operations is a methodology for planning, executing and assessing operations to attain the effects required to achieve desired national security objectives." AFDD 1

EBO …

- **is an approach, a way of thinking**
- **supports all missions from HUMRO to MTW**
- **utilizes lethal and nonlethal force**
- **offers an approach that models an "Enemy as a System"**
- **offers Economy-of-Force**
- **offers an approach to *Effects-based Dynamic ISR Management***

The challenge is predicting & assessing what physical actions

Comparison of Effects-Based, Objectives-Based and Targets-Based Operations

Target-Based (TBO)

- ID enemy entities, destroy them
- Focus: physical effects at target level
- Looks at 1st and 2nd order effects only
- No dynamic assessment
- No explicit timing considerations

Objectives-Based (OBO) (Strategies-to-

- Strategies at one level become objectives for
- Focus: objectives at every level
- Considers linkages between objectives and strategies to achieve those objectives
- No dynamic assessment
- No explicit timing considerations

Effects-Based (EBO)

- Address causality between actions and effect
- Focus: desired effects (physical and behavior
- Encompass both target and objective-based
- Models the enemy-as-a-system w/adversary
- Considers Direct, Indirect, Complex (synergis Cumulative & Cascading effects
- Timing explicitly considered
- "Overcoming" mechanism stated & assessed

Definitions

- **No doctrinal template in approved Joint doctrine**
  - **USAF Doctrine has rudimentary definitions**
- **Physical => Behavioral**
  - **destroy (damage), disrupt (Kosovo), degrade, dislocate, decapitate, divert, delay (isolate), deny (halt), deceive, defend, deter (D^{11})**
  - **coerce: punish, threaten (George, Schelling)**
- **Historically and theoretically behavioral most important but hardest**
  - **therefore, traditionally military operations focus on physical effects**
- **Major problems with behavioral effects:**
  - **causality between action & effect**
  - **observability of effect**
  - **uncertainty of intervening variables**

AFDD 2-1 Definitions

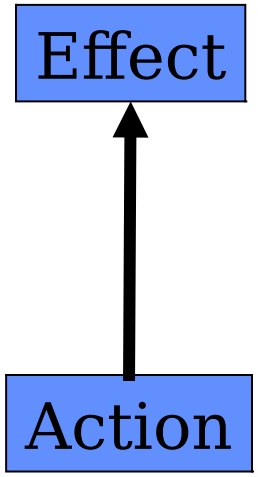
- Direct Effect
- Indirect Effect
- “Effects” described
- Limitations:
  - Precise definitions of “effects”
  - Effects versus Objectives
  - Conflating Mechanism
  - Connections between Direct & Indirect Effects
  - Complex or Cascading Effects

AFDD 2-1 Definitions

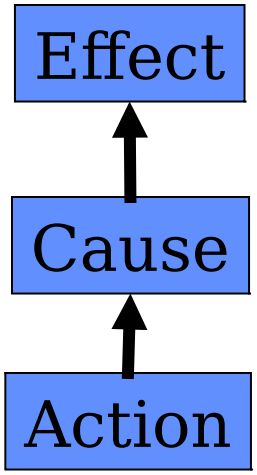
- **Direct Effect: “Result of actions with *no intervening effect or mechanism* between act and outcome. Direct effects are usually immediate and easily recognizable.” (AKA 1st order effect)**
- **Indirect Effect: “Result created through an *intermediate effect or mechanism* to produce the final outcome,which may be physical or psychological in nature. Indirect effects tend to be delayed,and may be difficult to recognize.” (AKA 2nd, 3rd,…, *n*-order effects)**

Effect

- **A result from some action**
  - **Assumes a causal connection**
  - **"IF *x* THEN *y*" is a statement of (direct) effect**
- **Point of View dependent**



AFDD 2-1



EBO CONOPS

Mechanism

- **Actions Cause Results (Effects)**
- **Mechanism explains cause**
  - **Rationale explains purpose (Commander's Intent)**
- **IF (*x*; action) THEN (y; result) BECAUSE (*a*, *b*, … ; mechanism)**
  - **Uncertainty in action, result and cause suggest a probability-based approach (Bayes)**
- **Clausewitz: if you defeat an enemy's fielded force, then a rational leader will submit because his country is undefended.**
- **Douhet: if you terrorize the population, then a rational leader will submit because the populace will rise up, rebel, and force submission.**

Mechanism continued

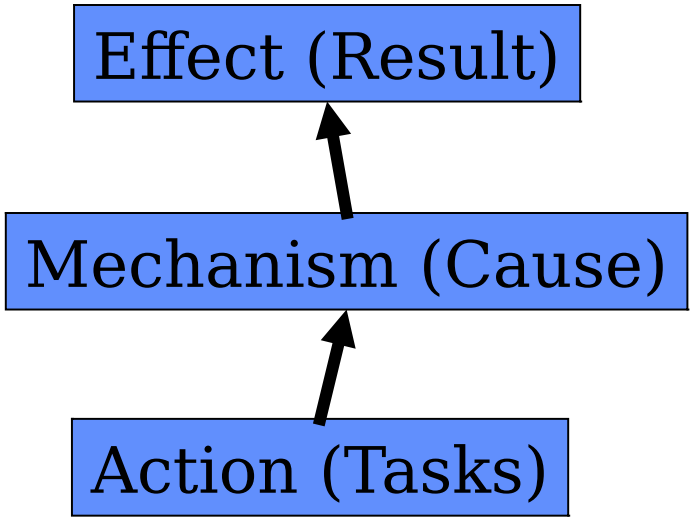
- **Slessor: if you interdict infrastructure or supply, then fielded forces will be less combat capable, making them easier to defeat which leads to…an undefended country.**
- **Schelling: if you threaten things leadership value, then they will submit rather than lose those things.**
- **Warden: if you isolate leadership, then they are prevented from doing something which would thwart our will. They submit because the imposed paralysis prevents them from doing otherwise.**

Mechanism finished

- **In reality these are few, if any, single mechanisms at work.**
  - **Direct and indirect effects combine to form complex and cumulative effects**
  - **Effects cascade for good or ill**
- **Predicting, then assessing, how physical actions spawn behavioral effects (I.e., results from actions) is *the* major challenge.**

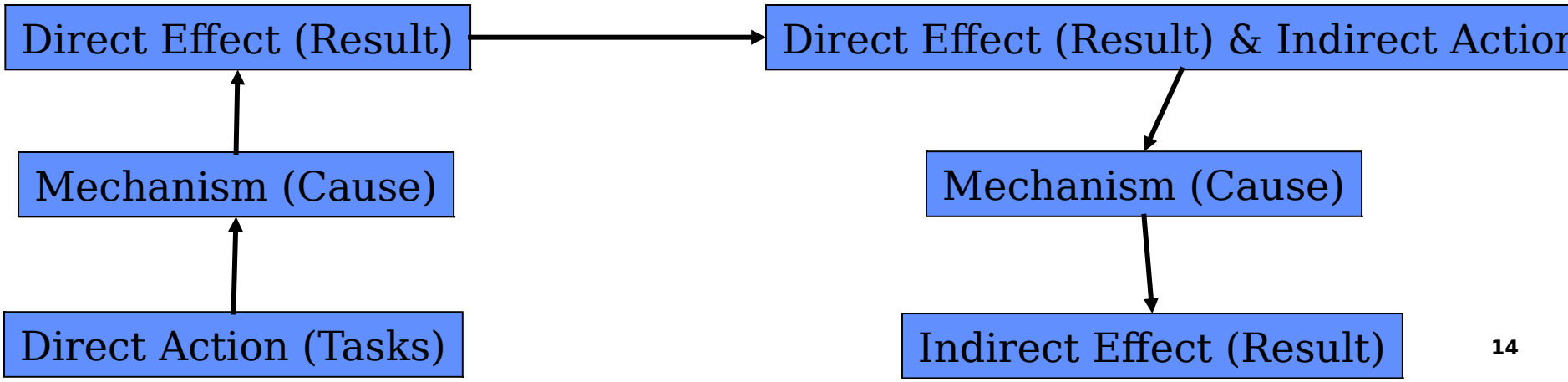
Actions & Tasks

- **Tasks are work (actions) to be done**
  - **Operationally, tasks are normally assigned to tactical units (squadrons, brigades, CVBGs, etc.)**
- **EBO theory is agnostic to the originator of action**



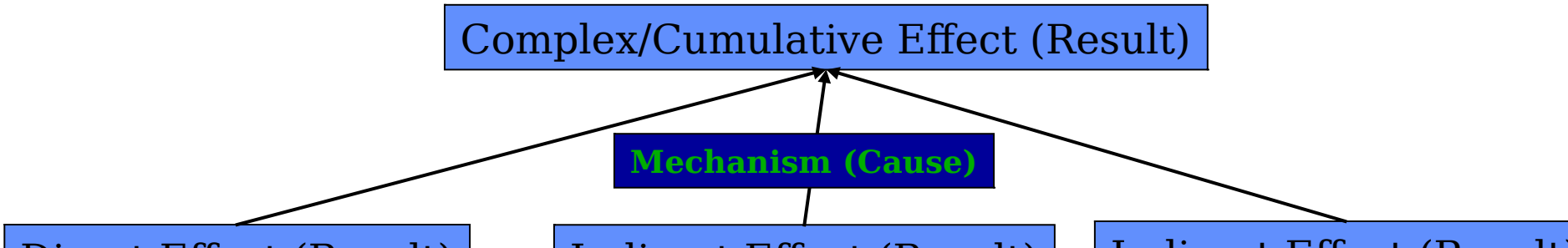
Direct & Indirect Effects

- **Direct Effects result from (caused by) direct actions.**
- **Indirect Effects result from (caused by) indirect actions.**
- **Indirect actions may be the result of a (previous) direct effect.**



Complex & Cumulative Effects

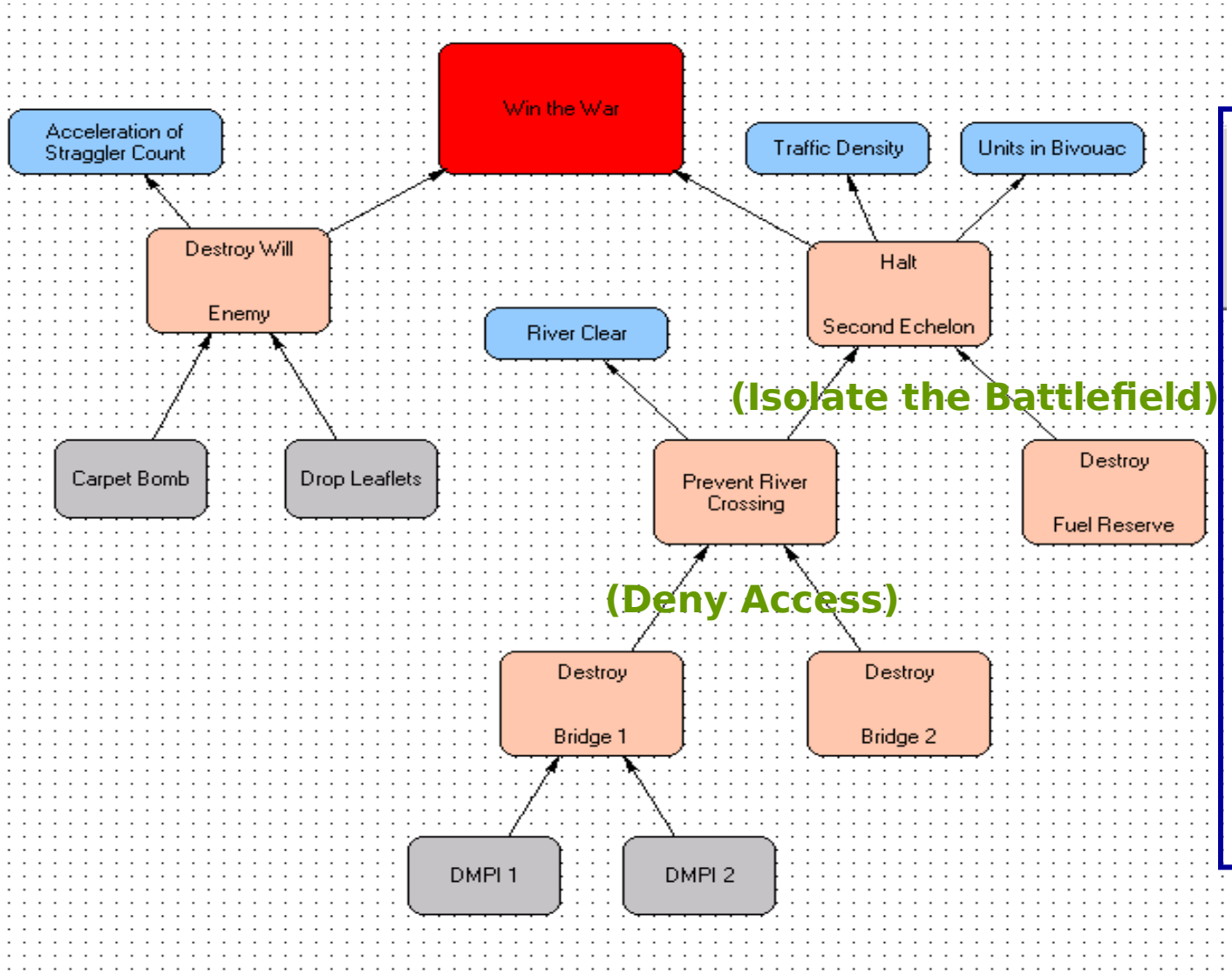
- **Complex Effects are a combination of effects, either direct or indirect, at an instant in time & space.**
  - **Mechanism explains how these effect combine**
- **Cumulative effects are complex effects as viewed over some time interval.**
  - **Effects do have persistence, though that generally varies**



Cascading Effects

- **Cascading effects are direct, indirect, complex or cumulative effects that ripple through a system**
  - **Captures the notions of an acceleration or a multiplier effect (from economics)**
  - **Requires a systems perspective: relationships, dependencies, or connections between elements**
- **Cascading effects can be vicious or virtuous but which they are is point of view (POV) dependent**
  - **What's bad for the bad guys is good from our POV but bad from theirs**
  - **In a HUMRO, what's good for the object of our attention is good from our POV and theirs**

Effects-Based Plan Representation



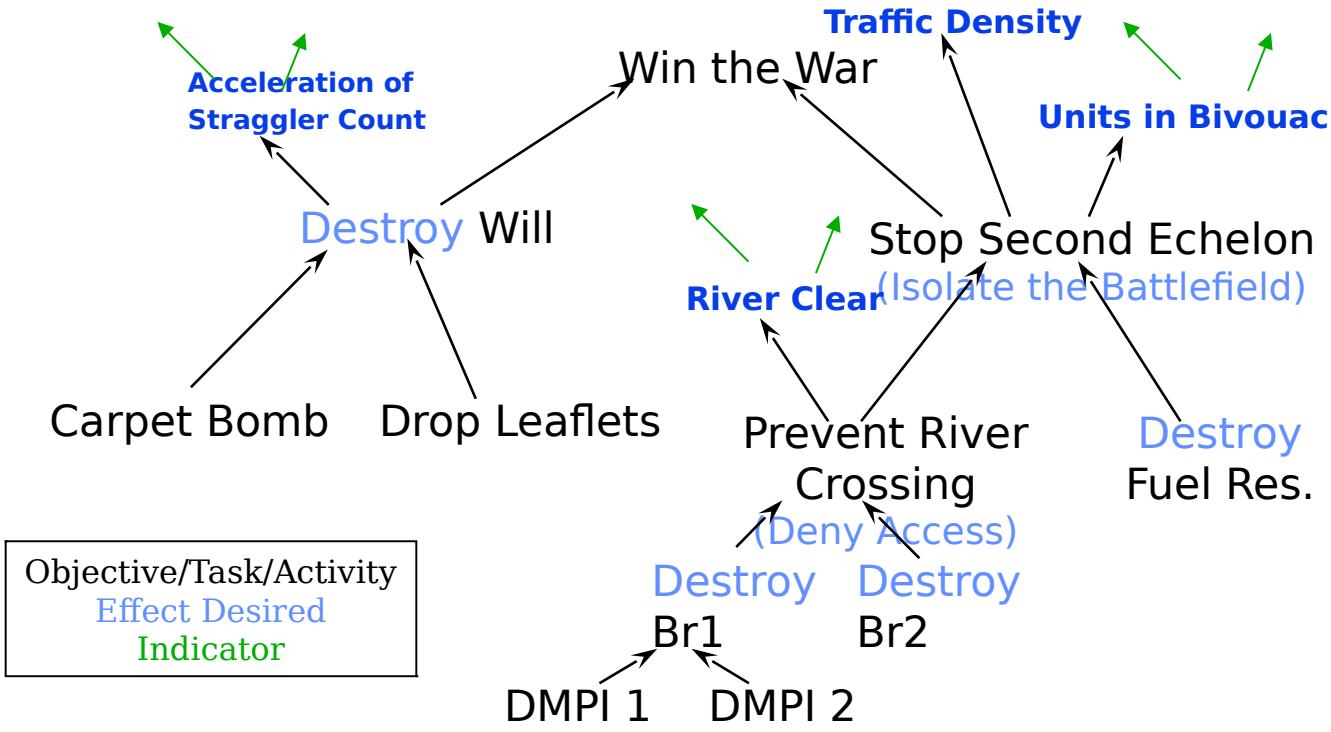
EBO Terms

- **Objective**
- **Effect Desired**
  - **direct effect**
  - **indirect effect**
  - **complex effect**
  - **cumulative effe**
- **Indicator**
- **Task/Activity**

(Mechanism)

Indicators

- **Are not effects**
- **Better to be observable then not but “not seen” does not mean “not there”**



Strategy: Definitions

- **The art & science of employing the armed forces…to secure the *objectives* of national policy by the application of force or the threat of force.** [JP 1-02]
- **A *means*[1] to accomplish an end.** [AFDD 2-1]
- **The use of *engagements* for the object of the war.** [Clausewitz]
- **The art of distributing & applying military *means*[2] to fulfill the *ends* of policy.** [B.H. Liddell Hart]
- **A *plan* of action designed in order to achieve some end; a *purpose* together with a system of measures for its accomplishment.** [RADM J.C. Wylie]

[1]tool, implement

[2]resources

Strategy, Objectives & Effects

- **Goal, Strategic Aim, End-State: the realm of policy—the decisive *results***
  - **An *end-state* is the set of required conditions that achieve the strategic objectives. [JP 3-0]**
- **Operational Art: determines *where*, *when* & *for what purposes* [*why*[2]]…forces will be employed**
  - **Use resources efficiently & effectively to achieve strategic objectives [JP 3-0]**
  - **Defines the parameters of operations (restraints & constraints) [FMFM 1-1]**
- **Effects: the result (outcomes) of direct actions (e.g., missions) and "indirect" actions (e.g., functions) [AFDD 2-1]**

[2]rationale

Ends, Ways, Means, Risk

- **Ends: What military *conditions* must be produced…to achieve the strategic *goal*?**
- **Ways: What sequence of *actions* is most likely to produce [those] condition(s)?**
- **Means[2]: How should *resources*…be applied to accomplish that sequence of actions?**
- ***Risk*: What is the likely cost…in performing that sequence of actions**

[JP 3-0]

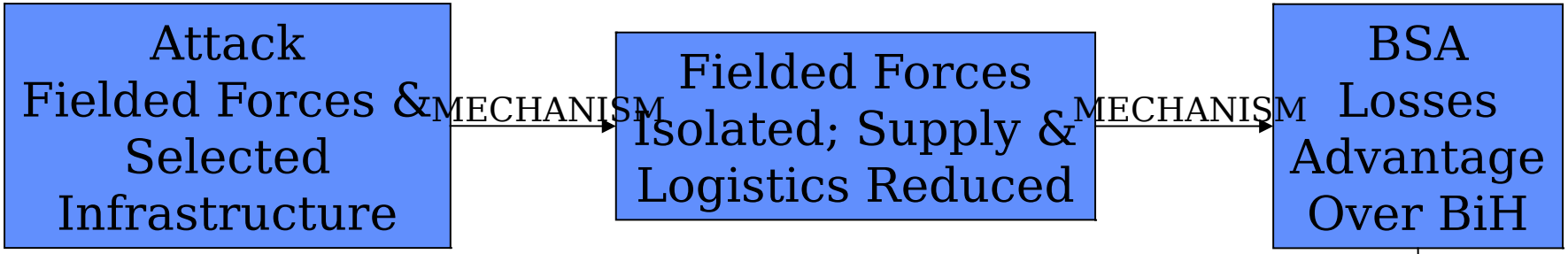
Strategy, CONOPS & COA

- **A verbal or graphic statement, in broad outline, of a *commander's* assumptions or *intent* in regard to an operation….It is included primarily for additional clarity of purpose.** [JP 1-02]
  - **Commander's Intent: end-state, purpose, method & risk**
- **A plan that would accomplish a mission. Includes CONOPS. Basis for the development of an OPLAN or OPORD.** [JP 1-02]
  - **Tasks—work to be done—given to tactical (engagement level) units to accomplish.**

Models

Basic Model

Actions cause.. ***Mechanism explains Cause!*** *...direct effect*



...direct effects and...

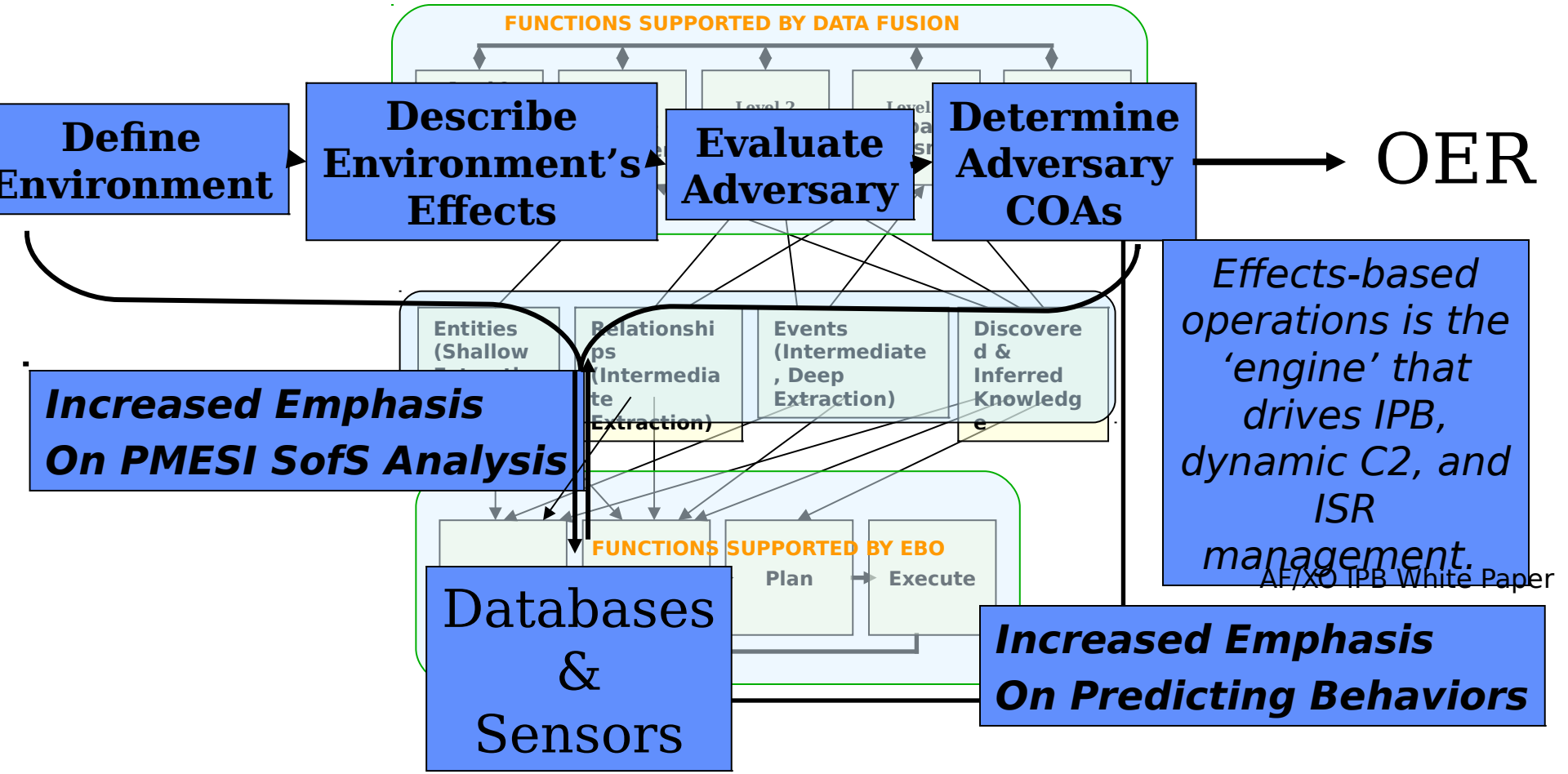
Key Requirements:

1. Predictive Models (e.g., IPB, Adversarial)
2. Common Ontology
3. Robust MS&A (e.g., Wargaming)

JIPB, ONA, PBA & EBO

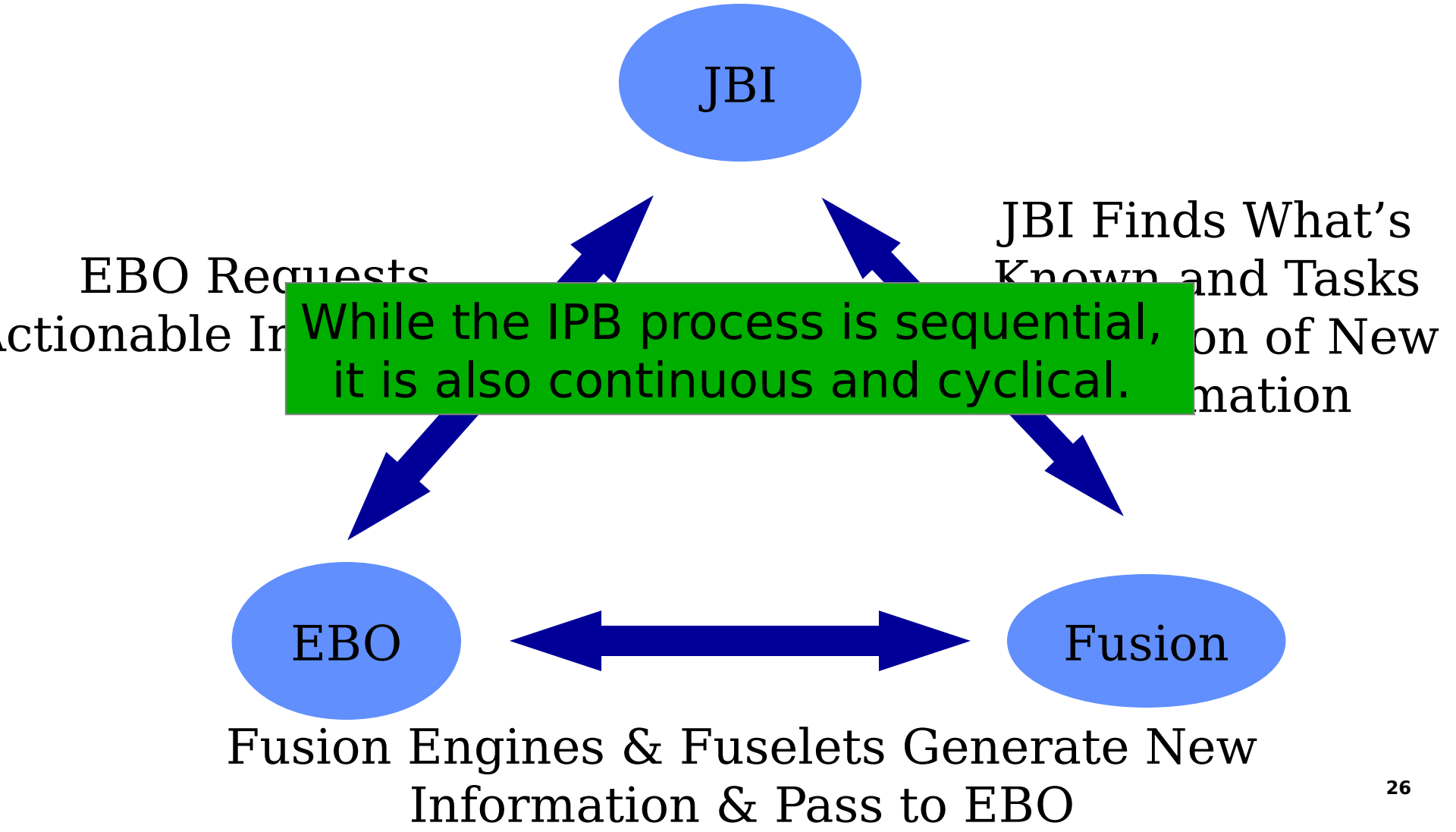
ONA: JIPB + COA Options (JFHQ Con. Of Employment)

PBA: JIPB + ISR Planning + ISR Management (PBA CONOPS

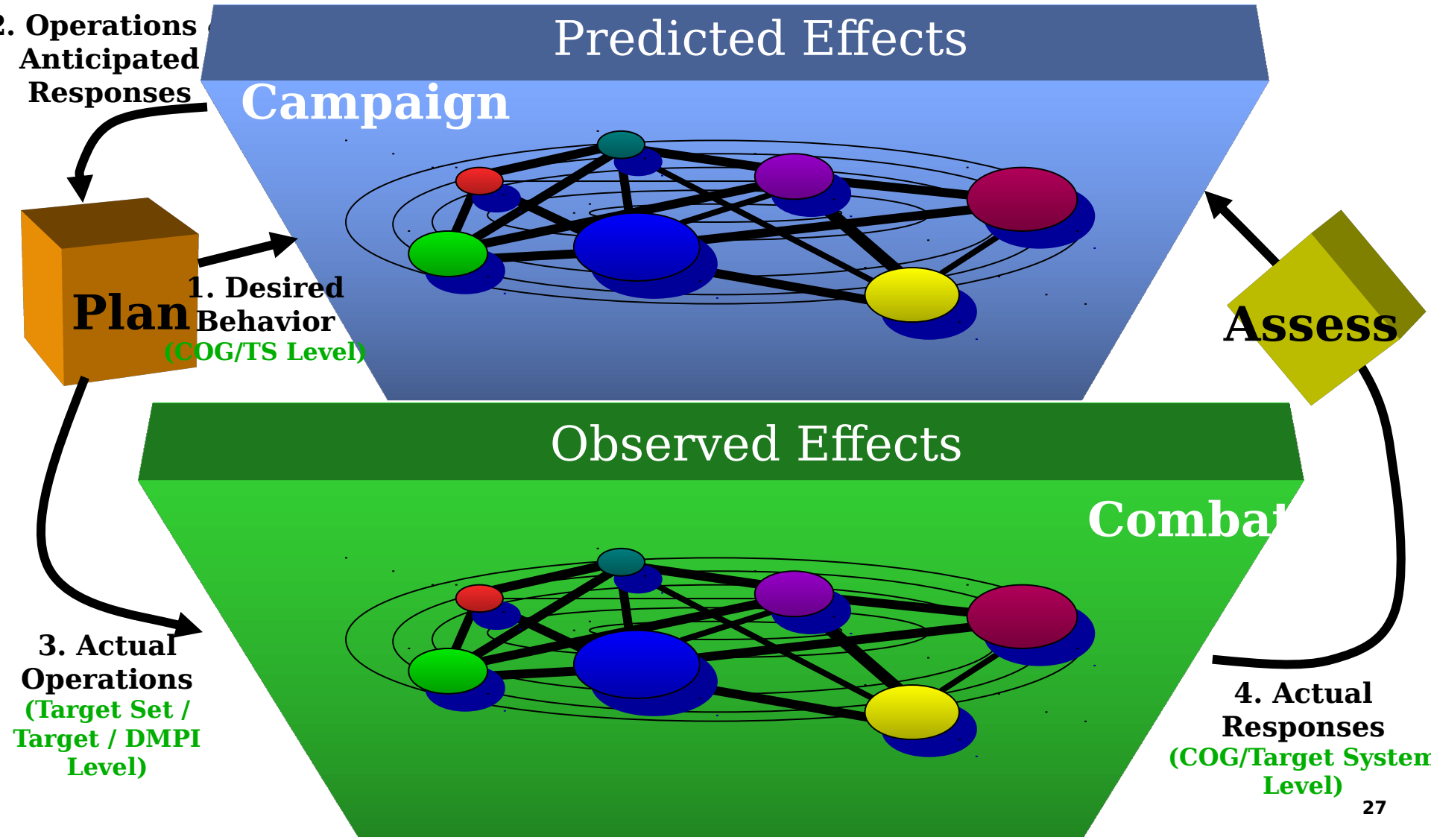


Supports JP 3-56.1 Stage I: Operational Environme

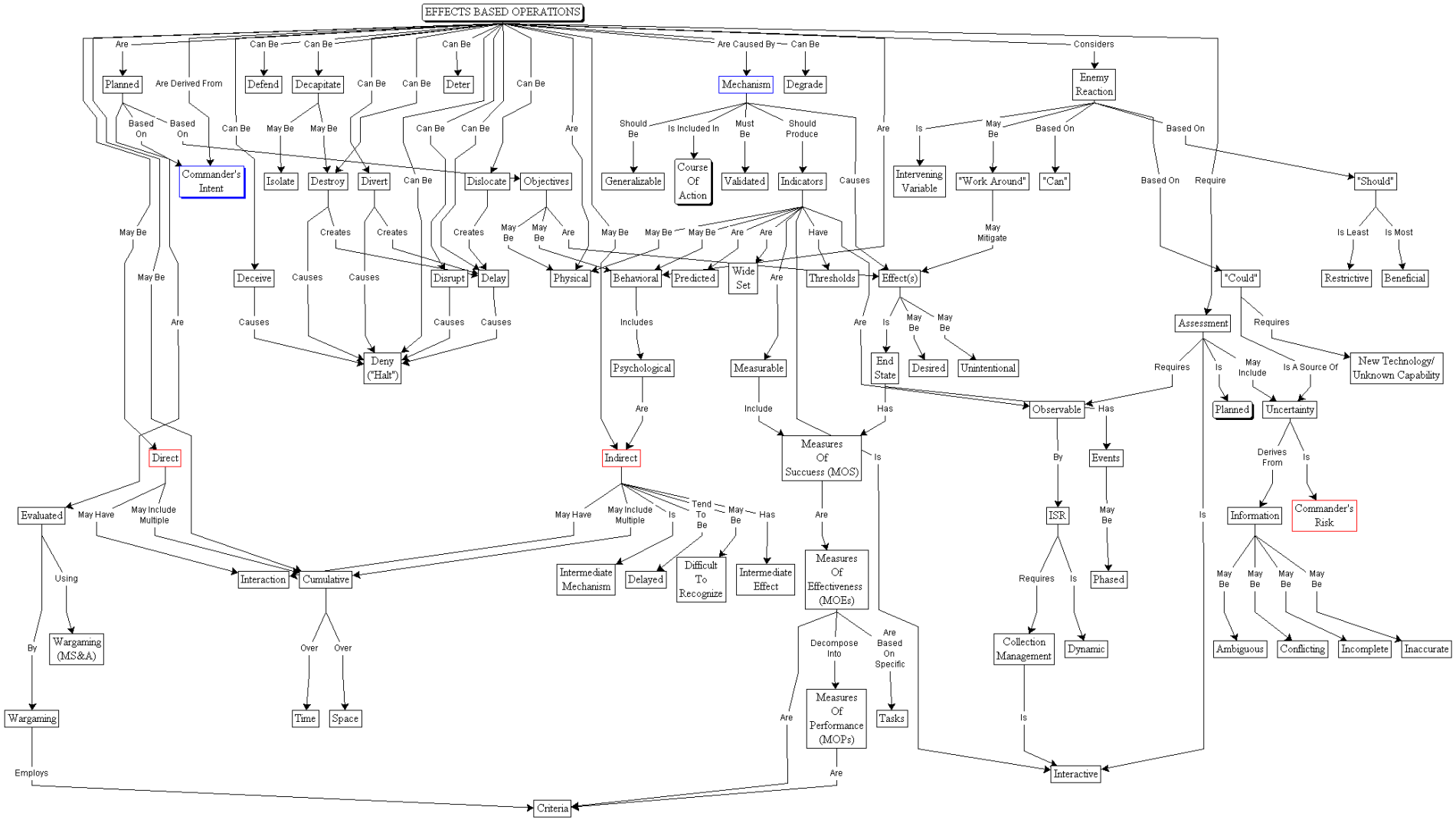
Working Together



EBO Macro Model



Semantic Network

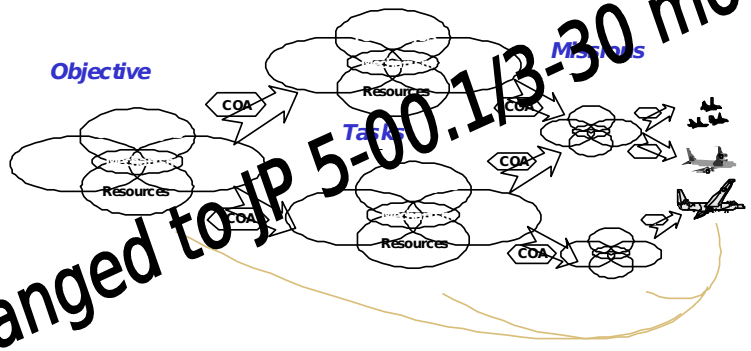


DoD TARA DUSD(S&T)

Effects Based Operations (DTO IS.71)

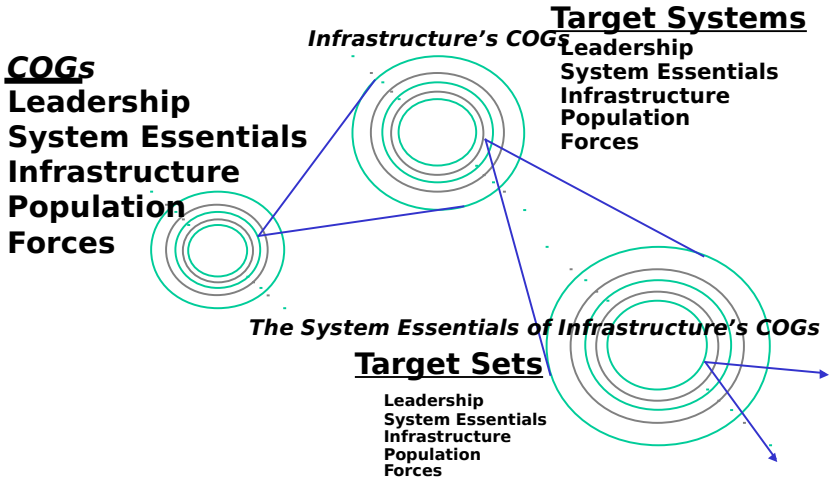
Approach to Modeling EBO

JP 3-56.1 Campaign Planning Model

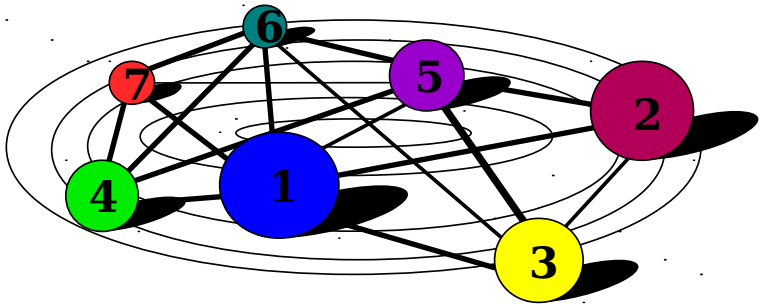


Changed to JP 5-00.1/3-30 model

Warden's "Enemy As A System" Mo



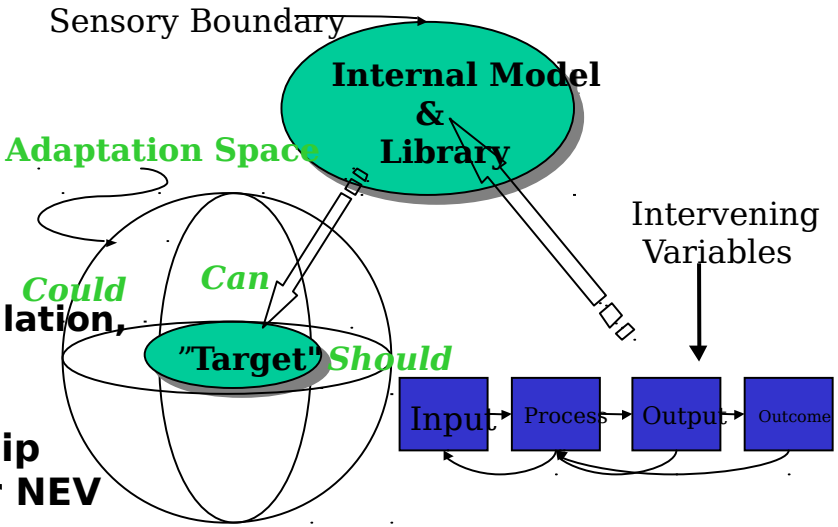
Barlow's "National Elements of Value" Model



1. Leadership, 2. Industry, 3. Armed Forces, 4. Population,
5. Transportation, 6. Communications, 7. Alliances

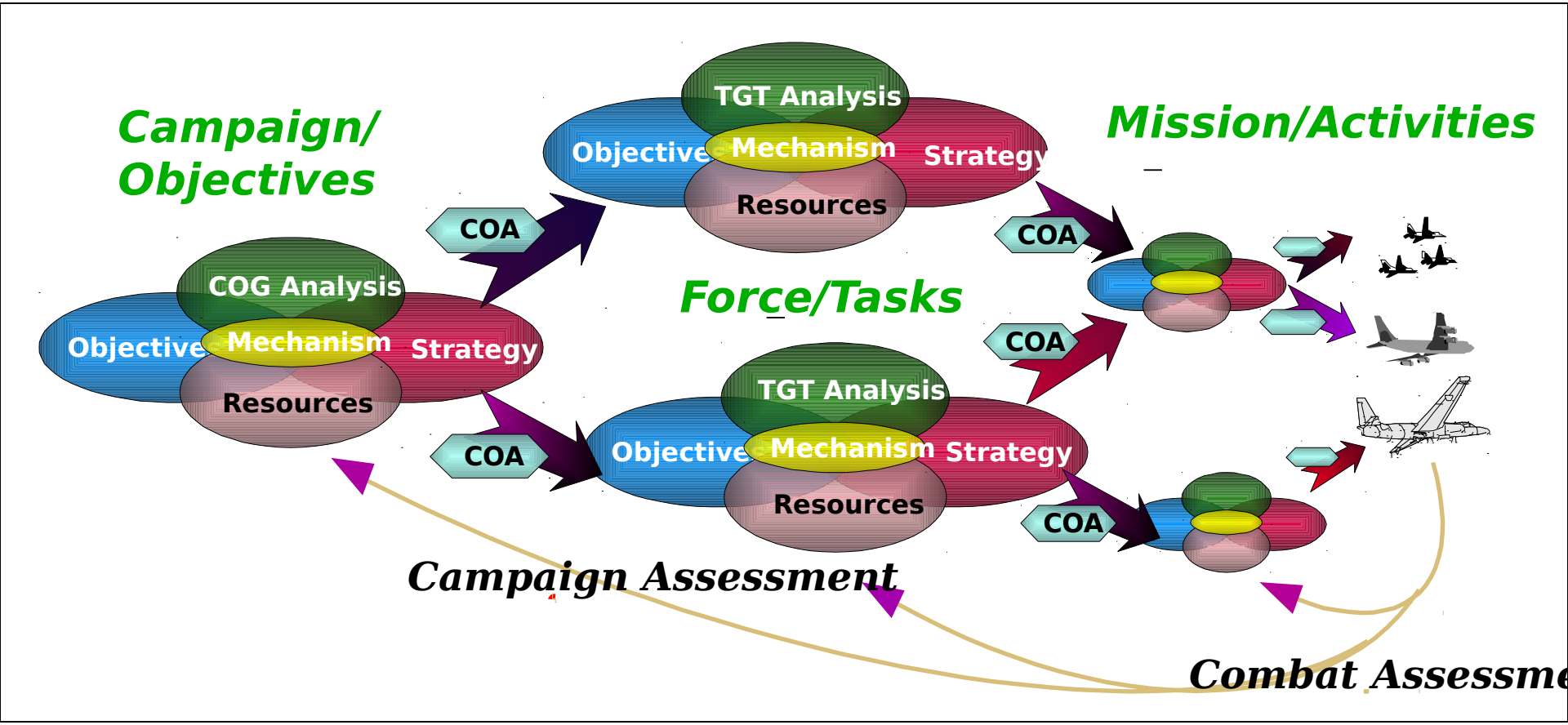
Size = Importance of NEV to National Leadership
Thickness = Importance of Connection to other NEV

McCrabb's "Enemy Reactions" Mo



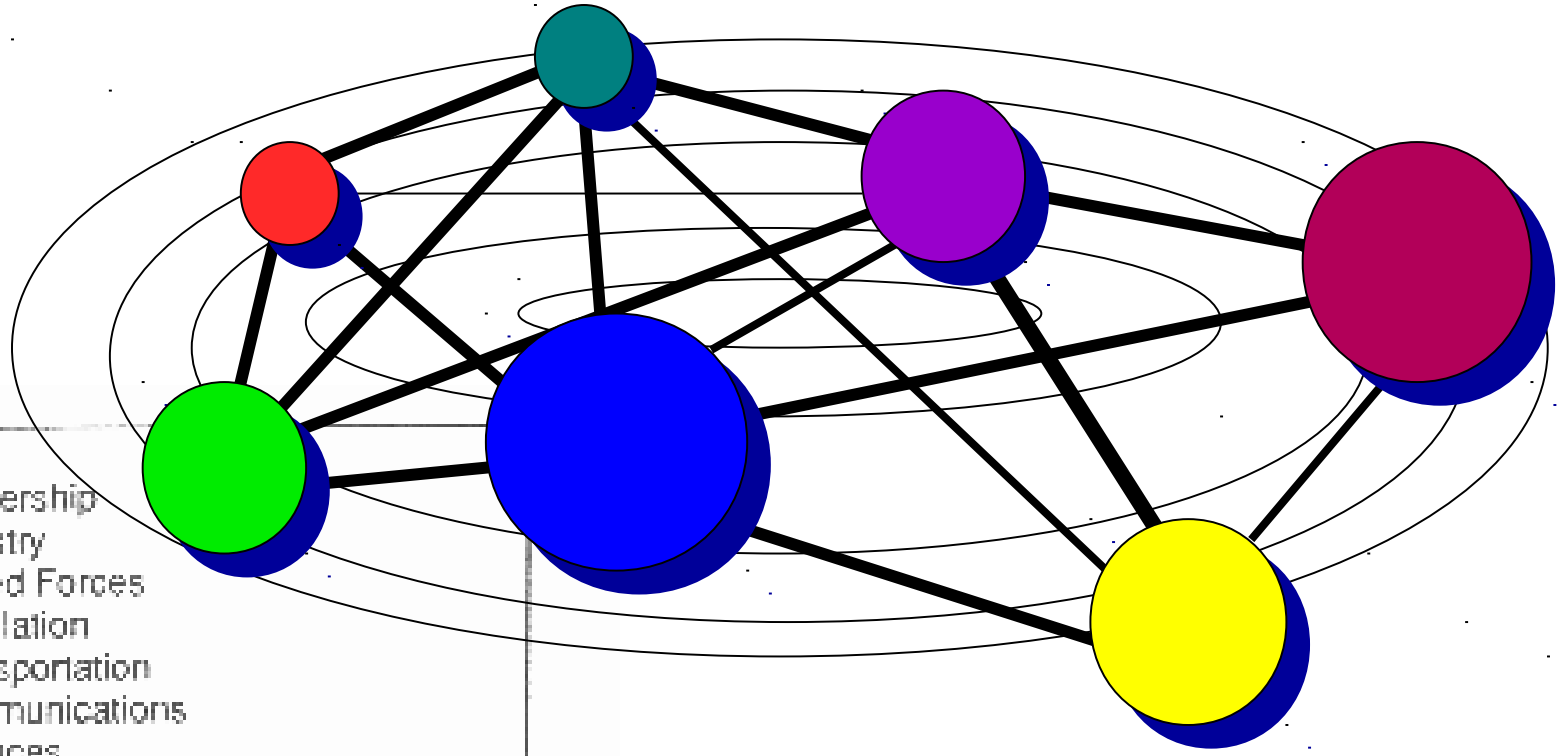
Campaign Model

Stage I: OER (IPB)



Modified from JP 3-56.1

Barlow's NEVs



1. Leadership
2. Industry
3. Armed Forces
4. Population
5. Transportation
6. Communications
7. Alliances

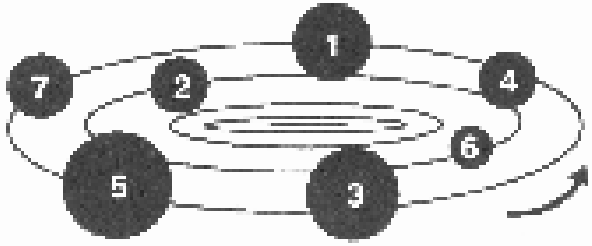


Figure 4. Model of Dynamic National Elements of Value

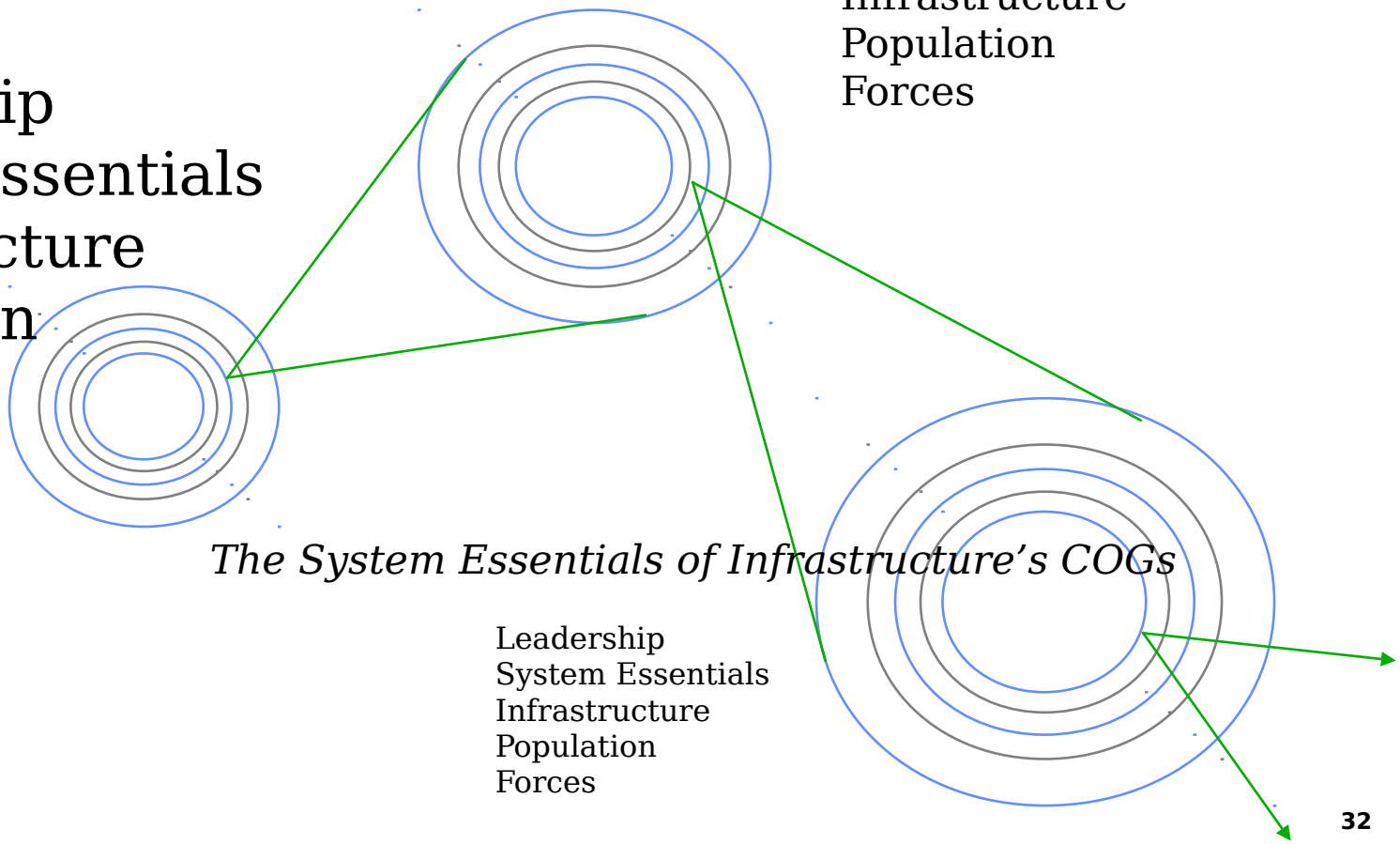
Stage III: COG Identificatio

Warden's "Rings" (Stage III)

COGs
Leadership
System Essentials
Infrastructure
Population
Forces

Infrastructure's COGs

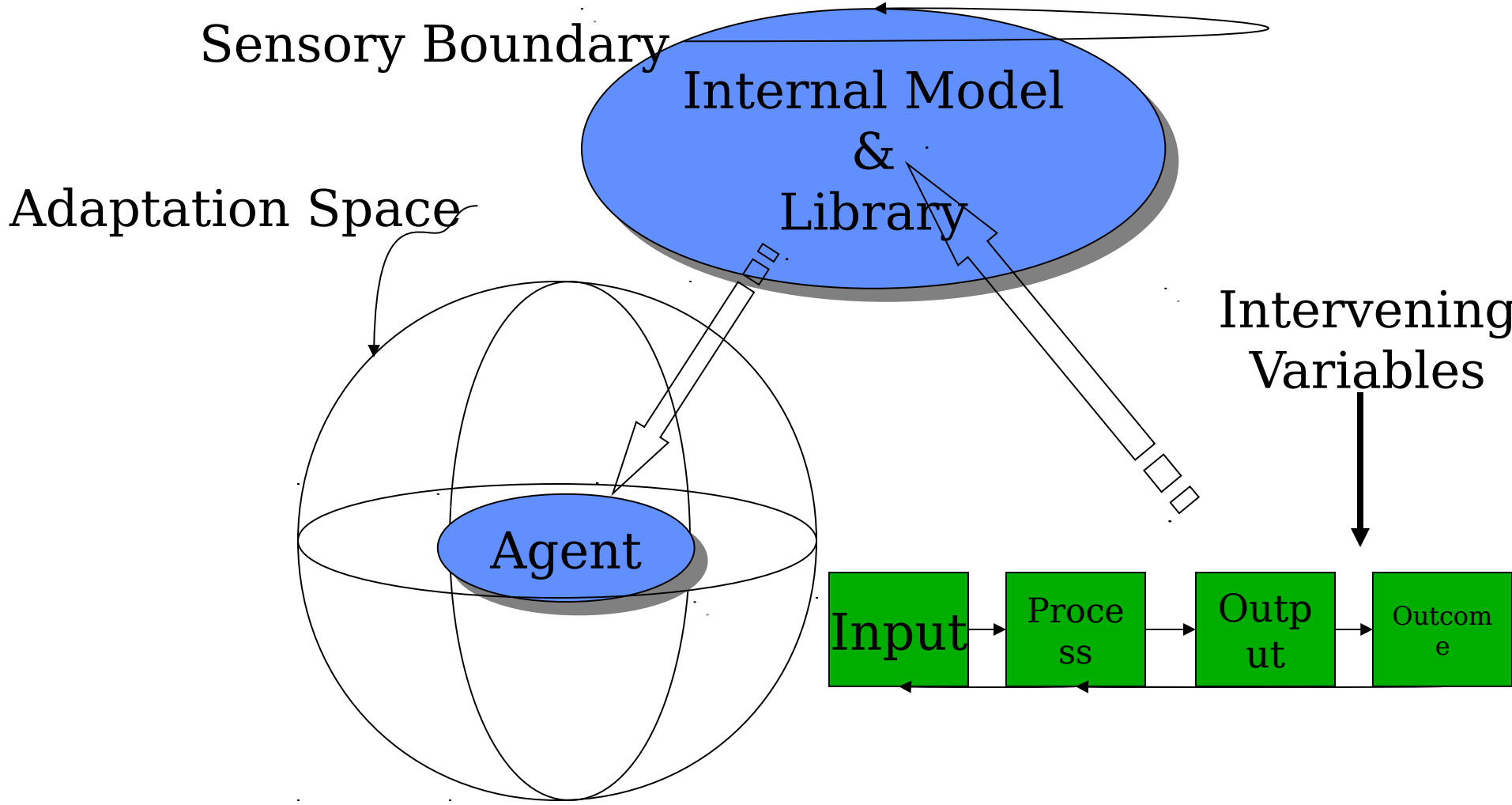
Leadership
System Essentials
Infrastructure
Population
Forces



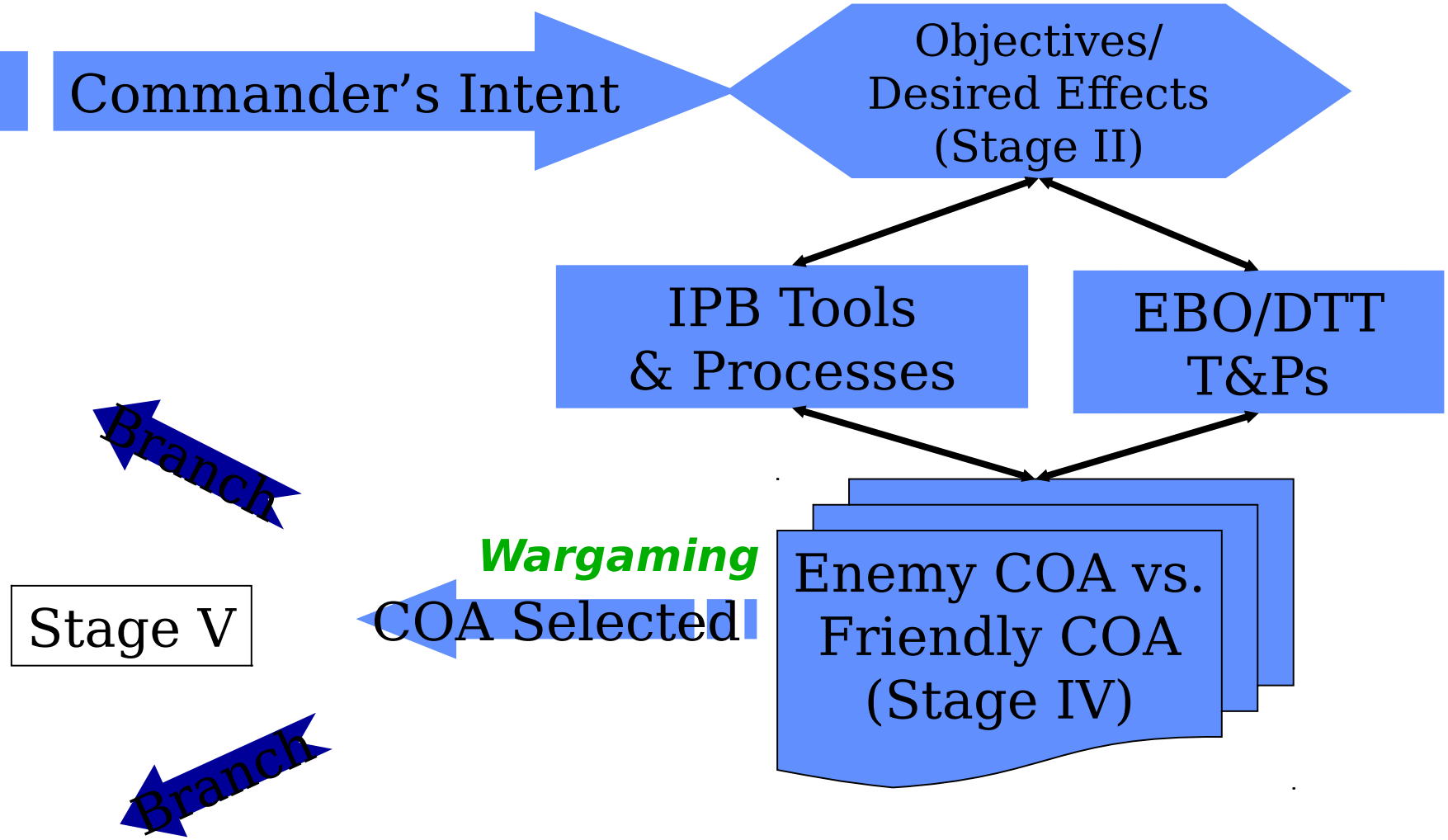
The System Essentials of Infrastructure's COGs

Leadership
System Essentials
Infrastructure
Population
Forces

McCrabb's Agent Adaptation Space
(Stage I-V)

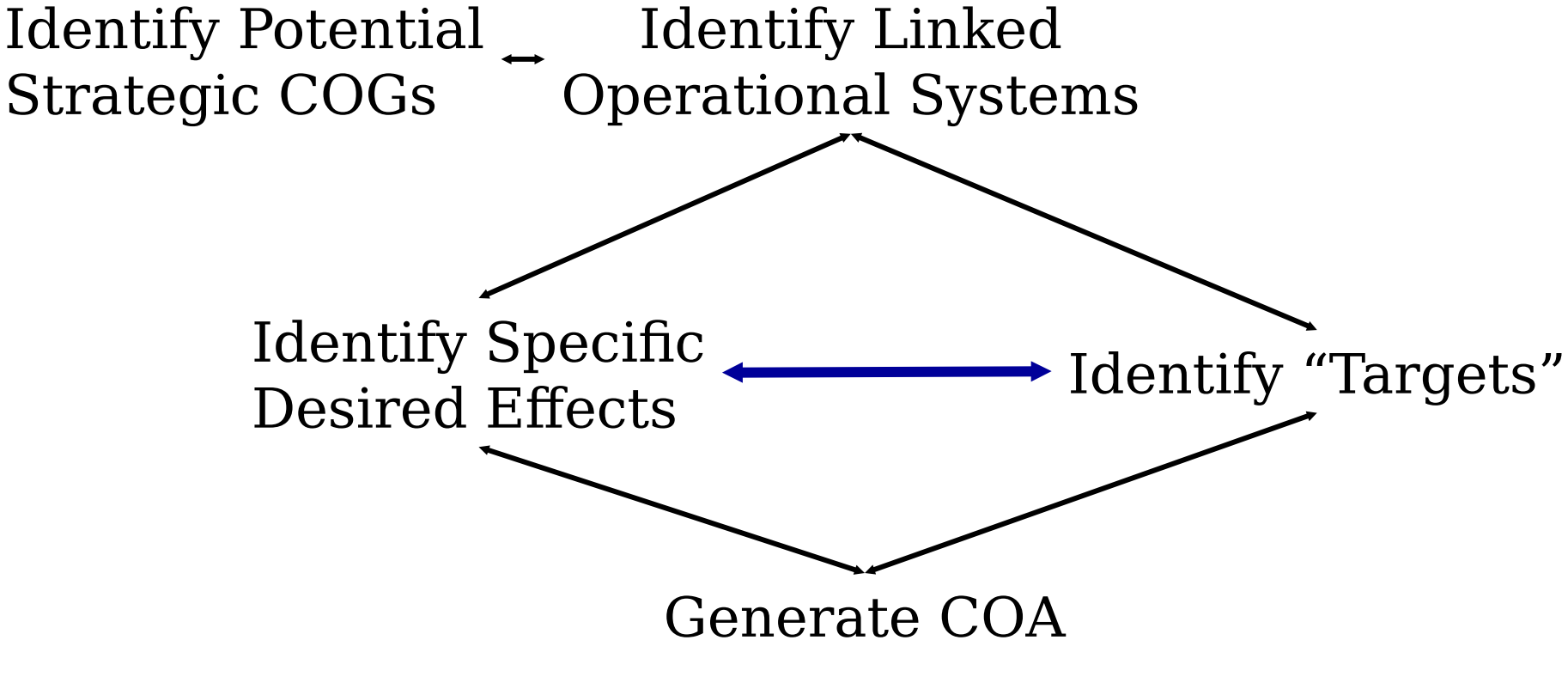


The (Almost) Complete Puzzle
(Stage I-V)



Effects-Based Planning

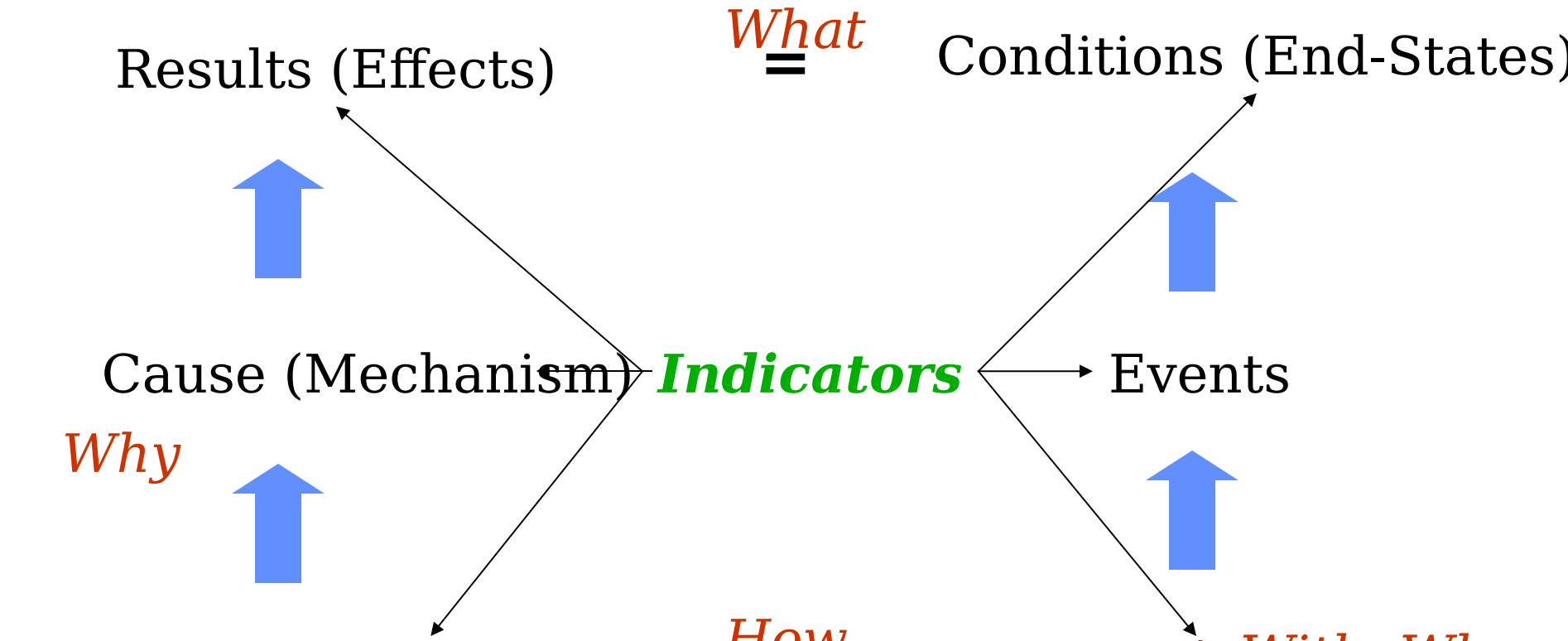
Everything Starts from Commander's Intent….



Supports JP 3-56.1 Stages II-V

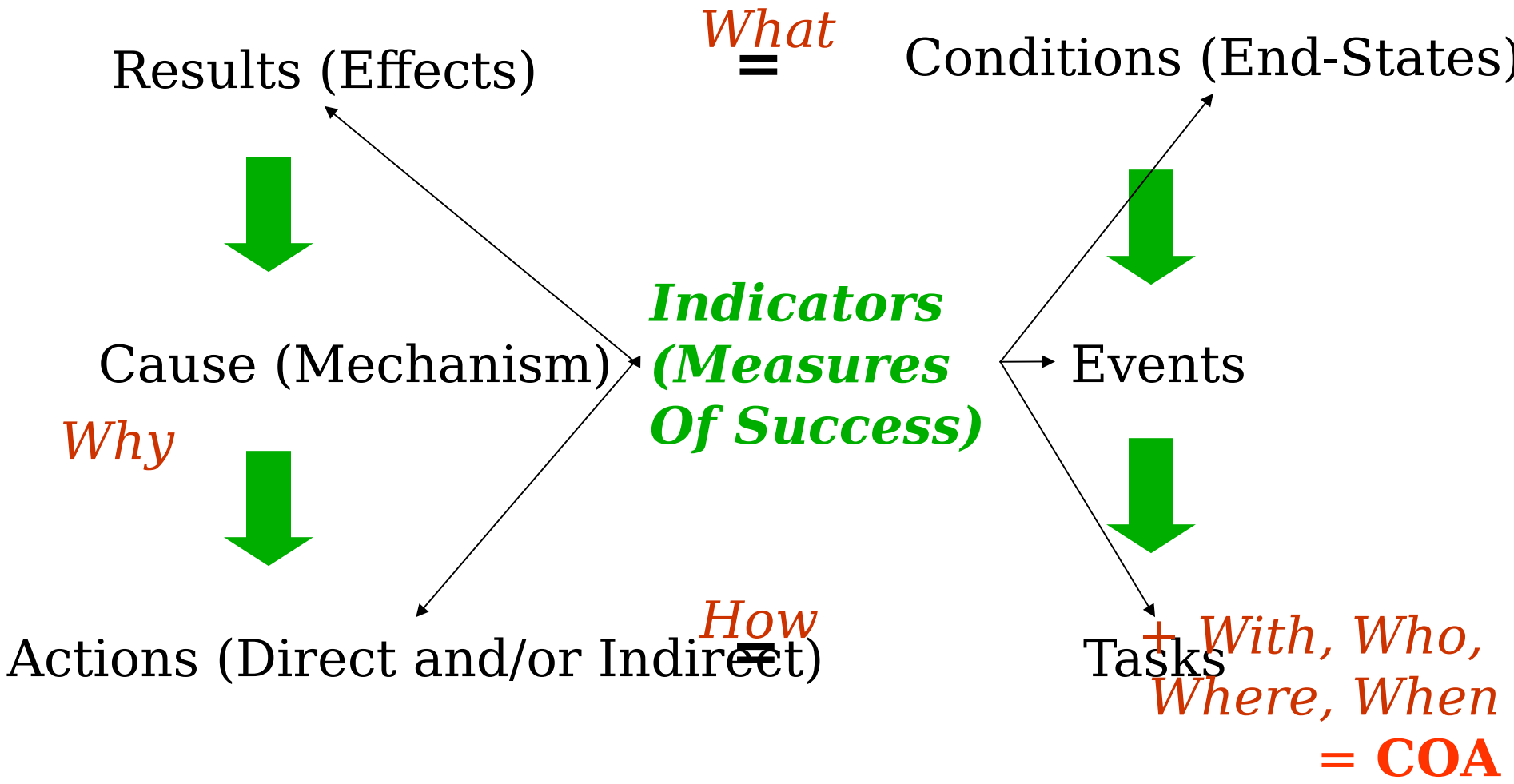
Modified from Dave Deptula's "Firing for Effect

Effects & Operational Art

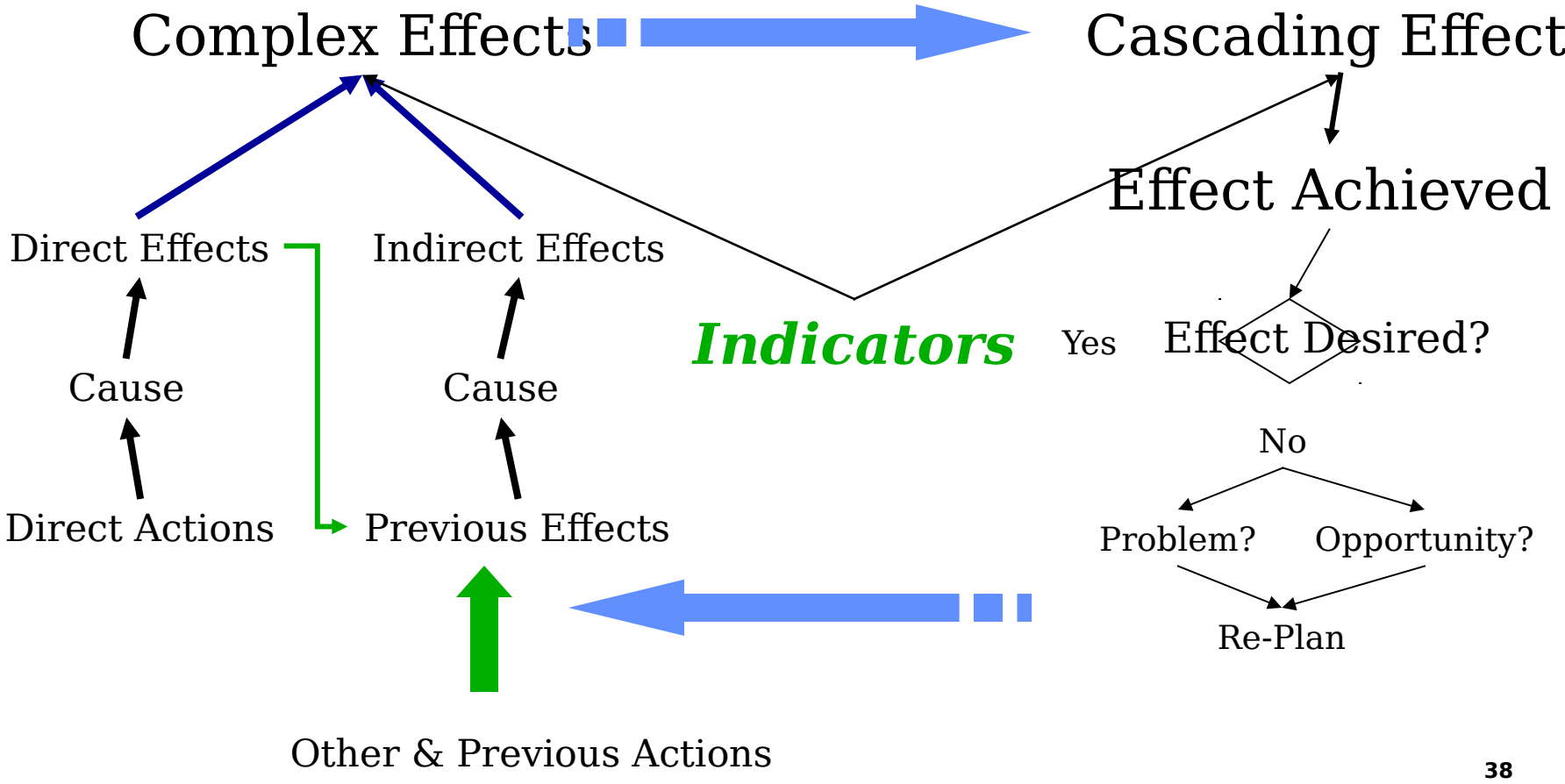


Strategy (Ways, How): A Plan of Actions (Tasks) that employ resources (means, with) To accomplish Ends (What)

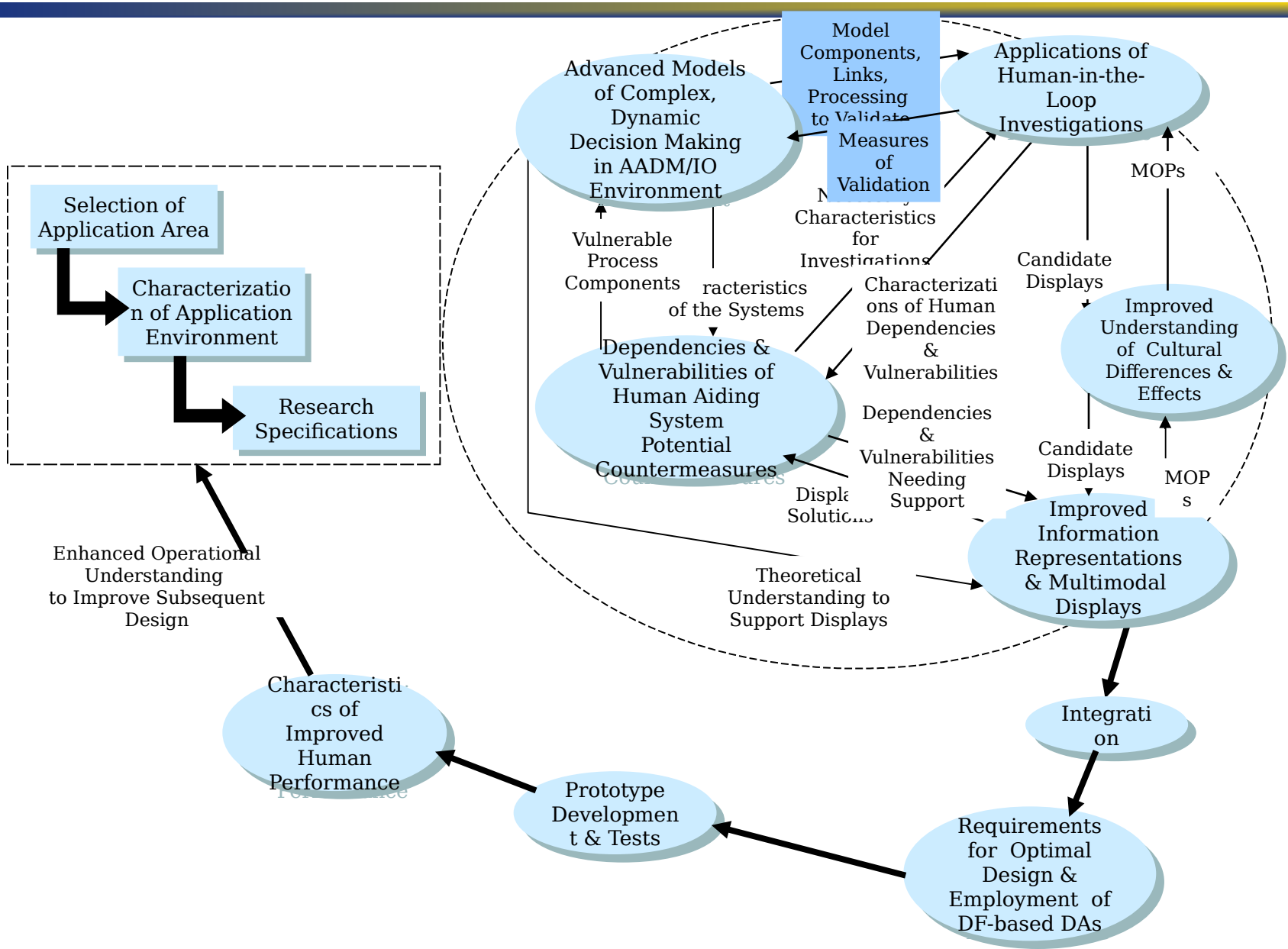
Planning (Stage V)



Execution & Assessment

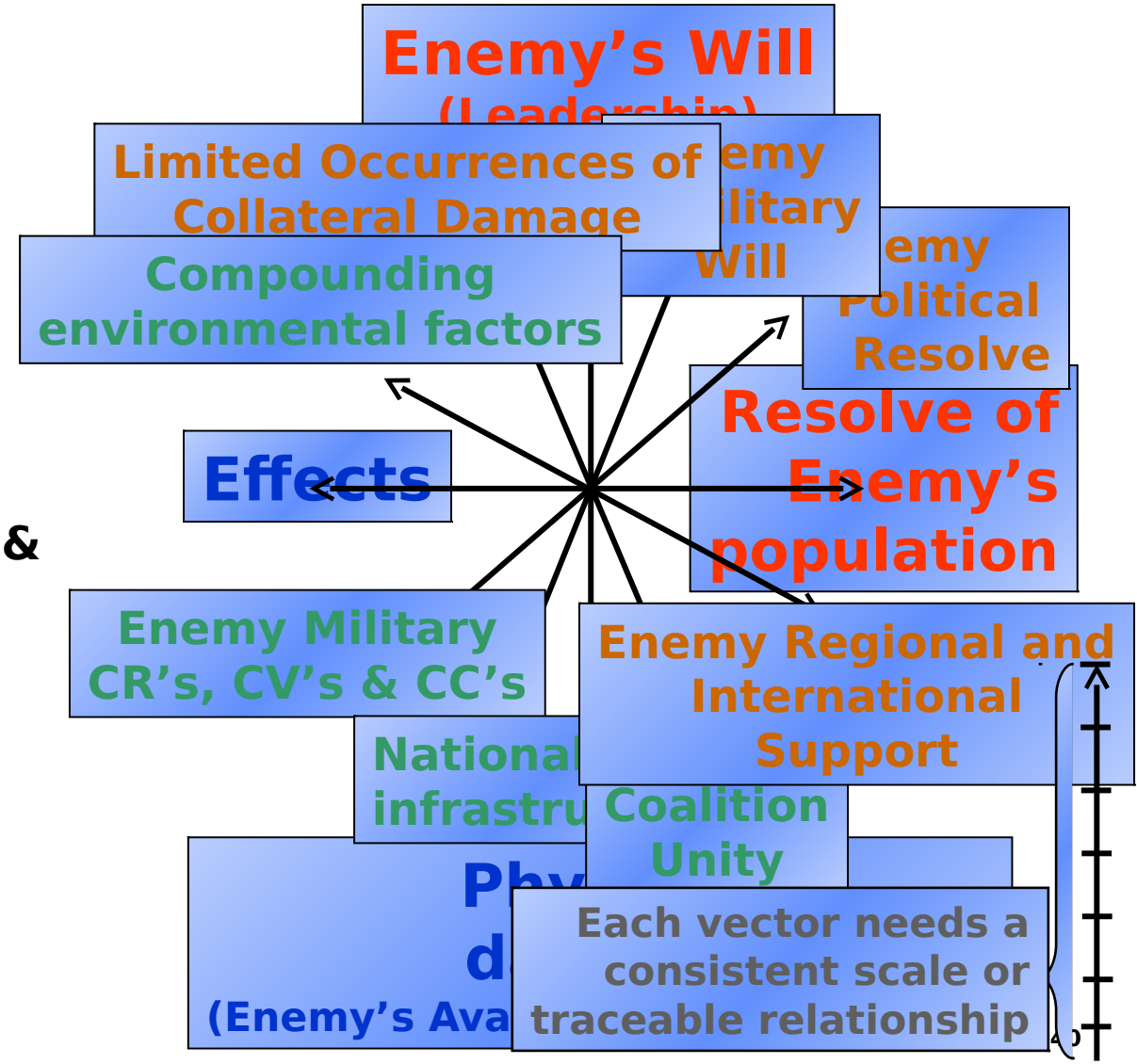


Adversarial Models

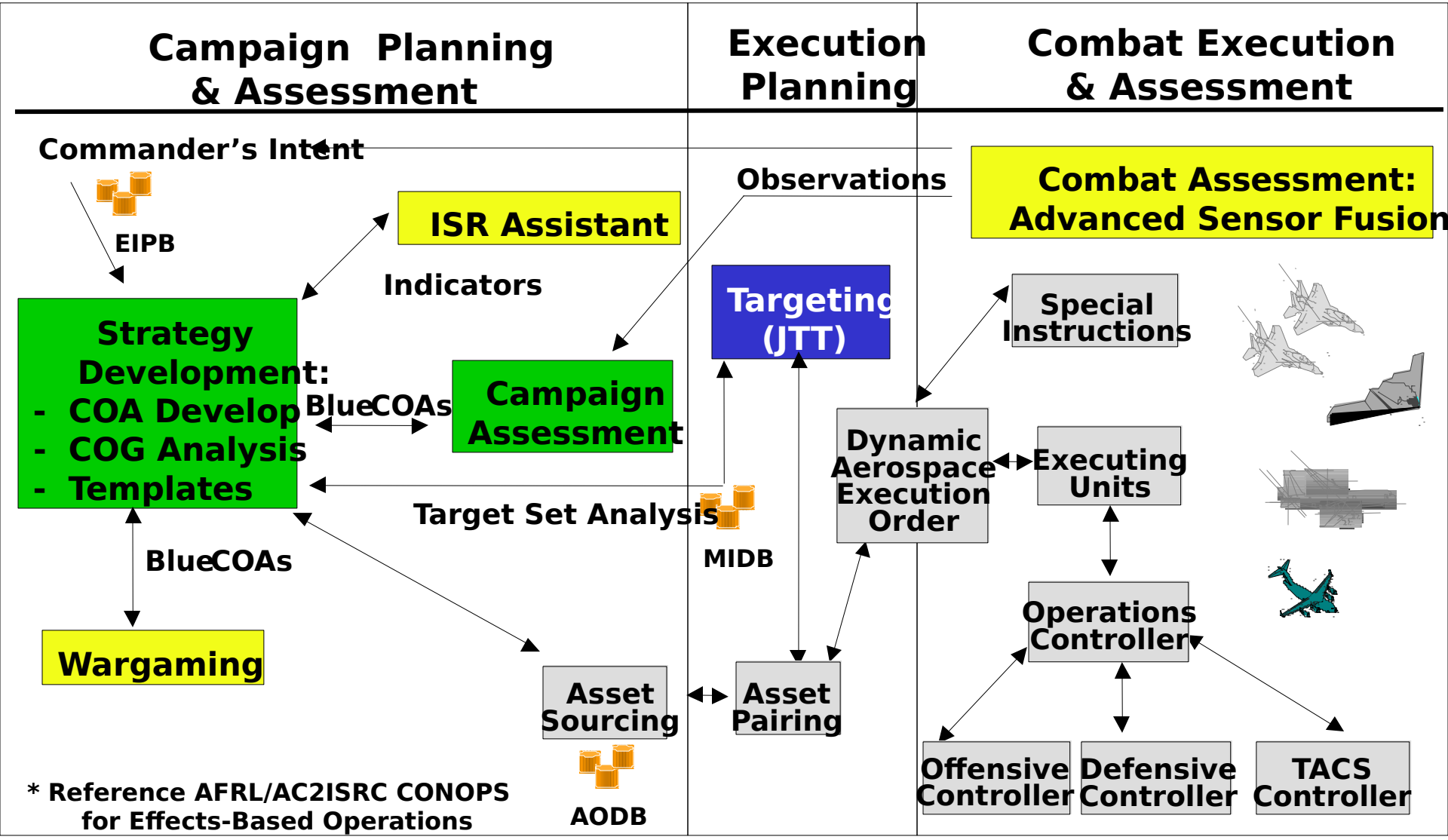

Selection of Application Area
Characterizatio n of Application Environment
Research Specifications
Advanced Models of Complex, Dynamic Decision Making in AADM/IO Environment
Model Components, Links, Processing to Validate
Measures of Validation
Applications of Human-in-the-Loop Investigations
MOPs
Vulnerable Process Components
racteristics of the Systems
Characterizati ons of Human Dependencies & Vulnerabilities
Candidate Displays
Improved Understanding of Cultural Differences & Effects
Dependencies & Vulnerabilities of Human Aiding System Potential Countermeasures
Dependencies & Vulnerabilities Needing Support
Candidate Displays
MOP s
Improved Information Representations & Multimodal Displays
Theoretical Understanding to Support Displays
Enhanced Operational Understanding to Improve Subsequent Design
Characteristi cs of Improved Human Performance
Prototype Developmen t & Tests
Integrati on
Requirements for Optimal Design & Employment of DF-based DAs

Big Picture

- **EBO ATD seeks an integrated set of strategy, wargaming, COG analysis, and campaign assessment tools.**
- **Doctrinally sound; not dogmatically rigid**
- **Support EBO planning & assessment plus objectives-based or targets-based assessment**
- **Major Theater War => Humanitarian Relief; lethal & nonlethal; kinetic & non-kinetic (e.g., Info Ops)**

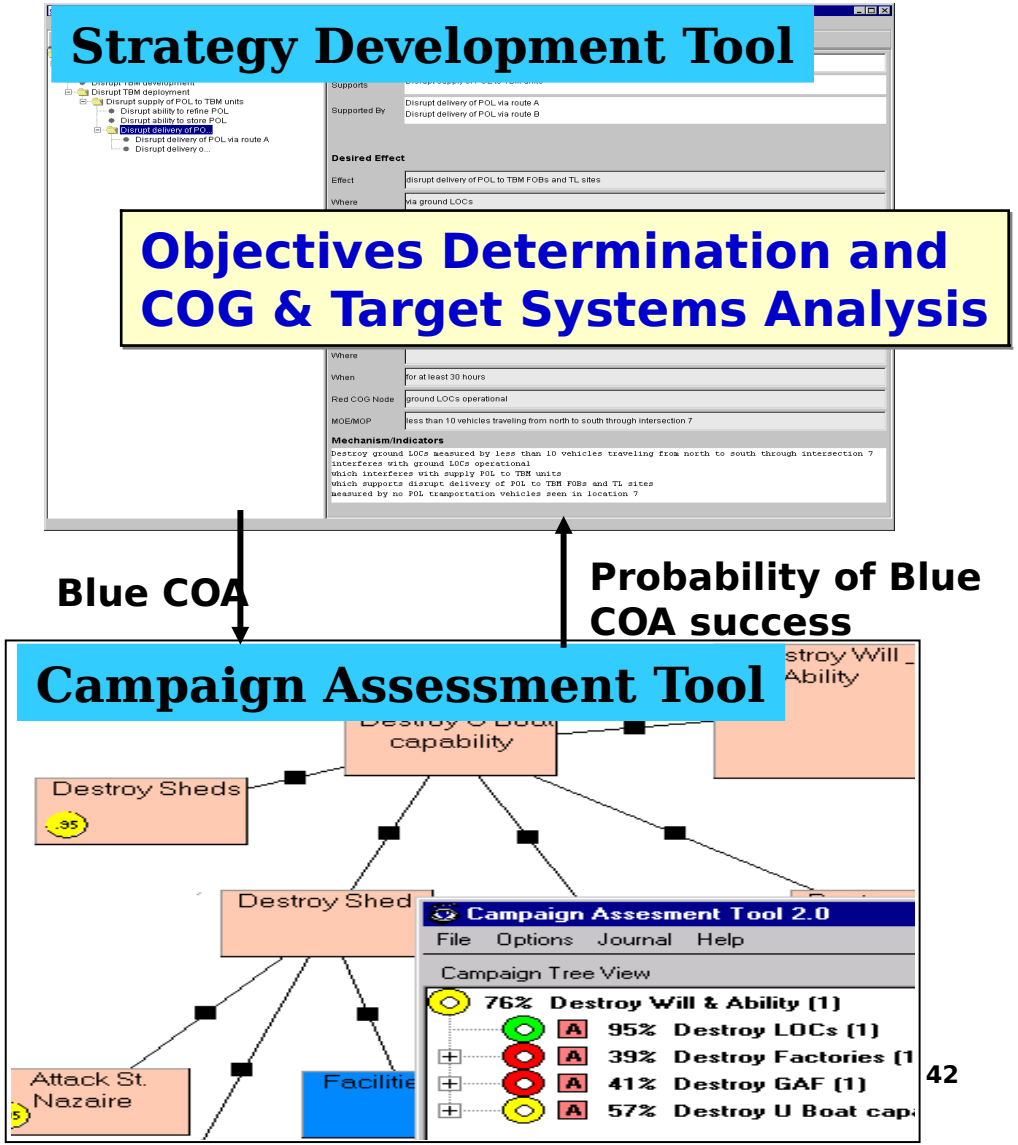


EBO Toolkit of the Future for Dynamic Tasking

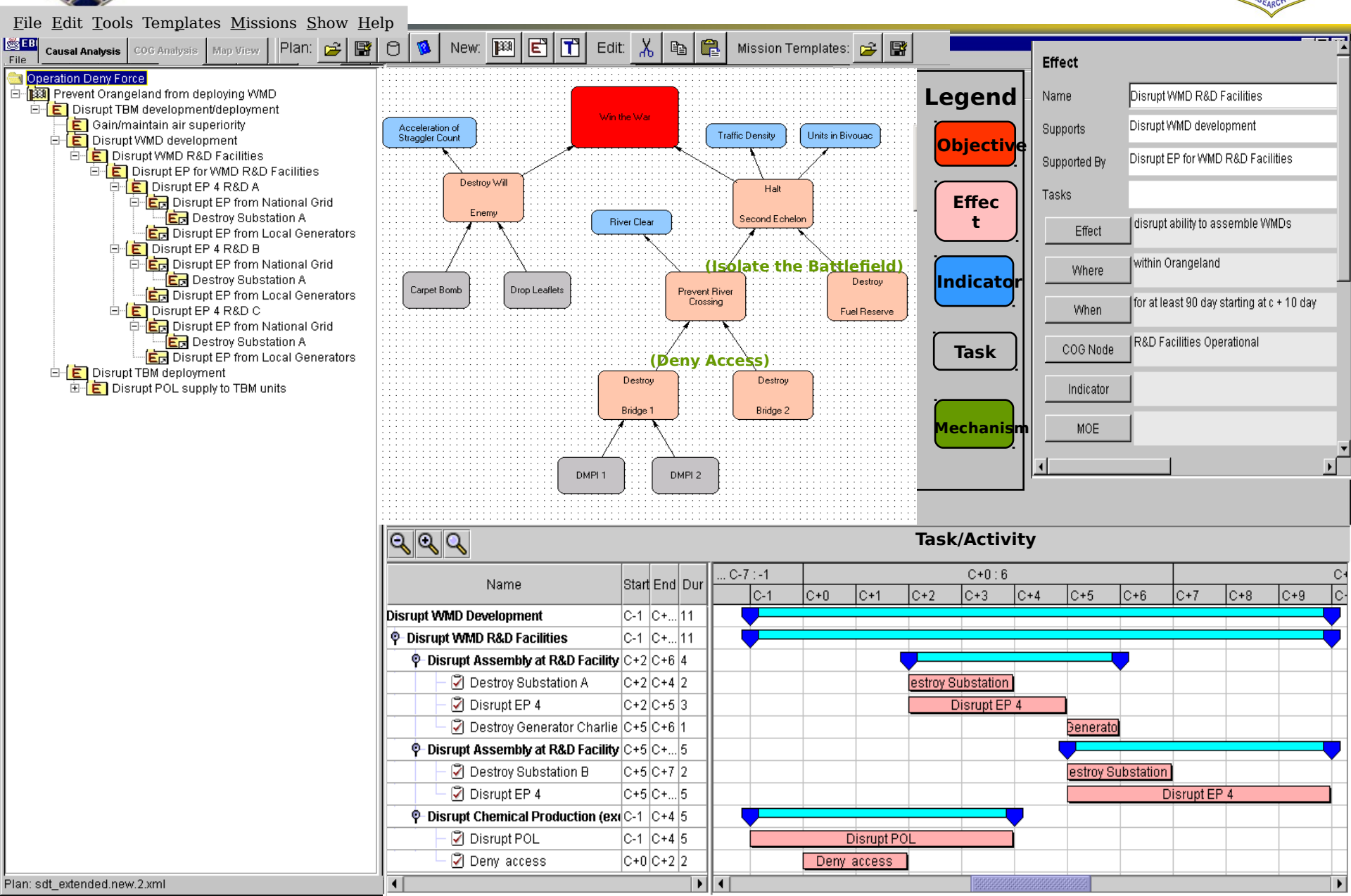


EBO Key Products

- Strategy Development Tool
  - produces blue COAs
  - tightly integrates effects, center of gravity/target system analysis & strategy identification
  - cross center of gravity interactions
  - strategy & mission templates
- Campaign Assessment Tool
  - predicts the probability of achieving Commander's intent for a blue COA
  - model plan's cause/effects relations for a given campaign over time
  - tradeoff analysis/drill down capability

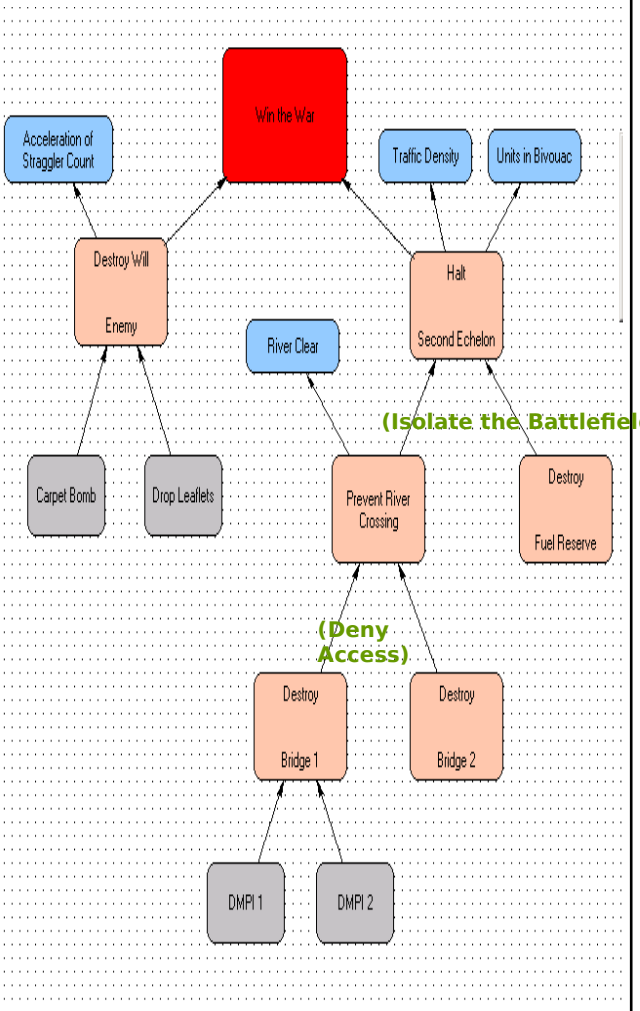


Strategy Development Tool Overview

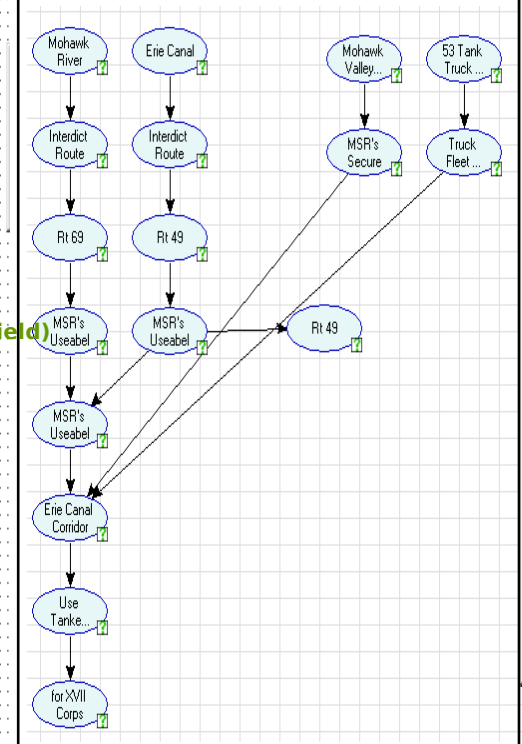


Campaign Assessment Tool Overview

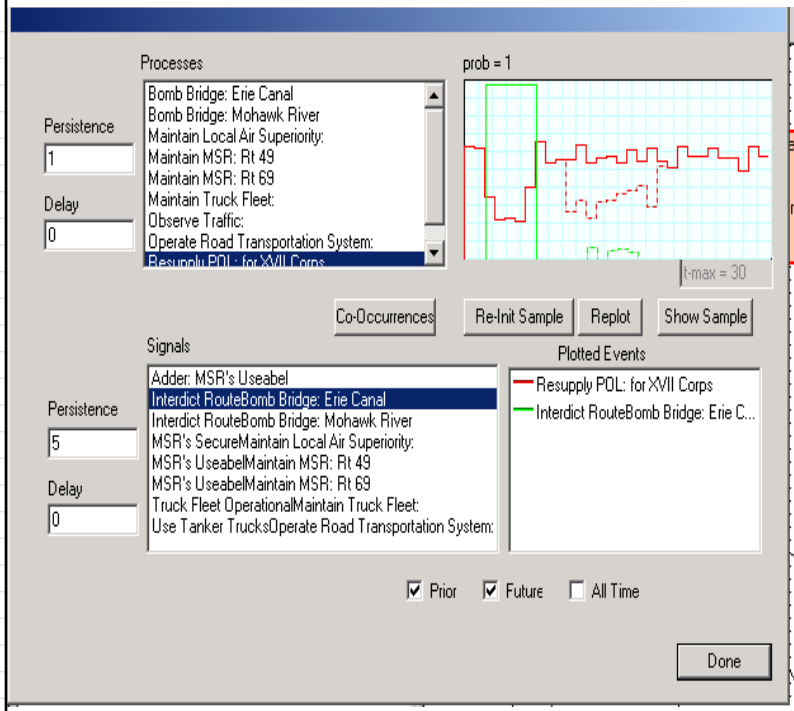
Build A Causal Model



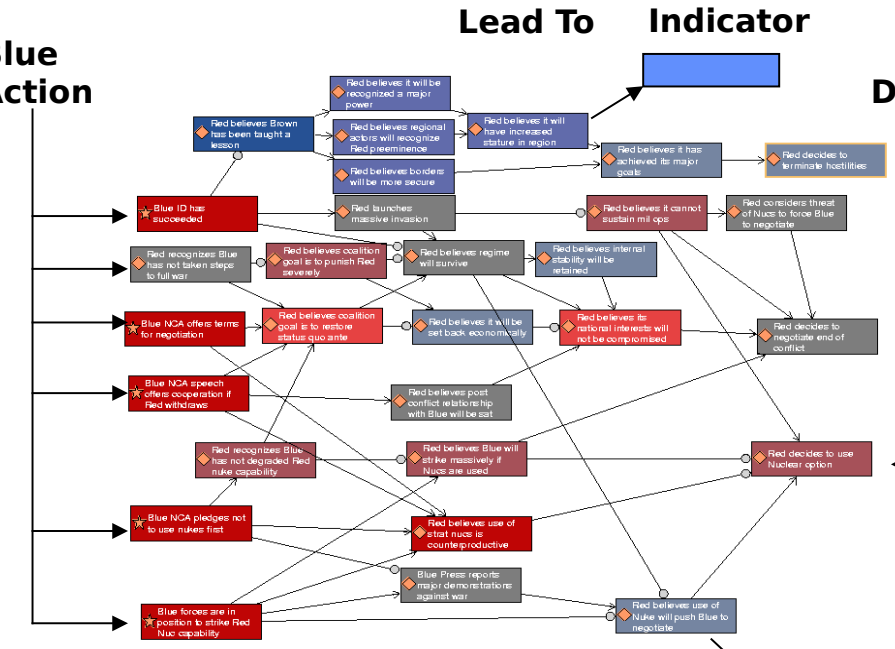
Compile to a Bayes Net



Analyze Results



EBO Approach to Homeland Defense

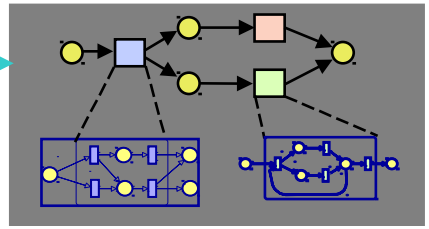

Blue Actions
Lead To
Indicator
Red Decisions
Red believes it will be recognized a major power
Red believes Brown has been taught a lesson
Red believes regional actors will recognize Red preeminence
Red believes it will have increased stature in region
Red believes it has achieved its major goals
Red decides to terminate hostilities
Red believes borders will be more secure
Blue ID has succeeded
Red launches massive invasion
Red believes it cannot sustain mil ops
Red considers threat of Nucs to force Blue to negotiate
Red recognizes Blue has not taken steps to full war
Red believes coalition goal is to punish Red severely
Red believes regime will survive
Red believes internal stability will be retained
Blue NCA offers terms for negotiation
Red believes coalition goal is to restore status quo ante
Red believes it will be set back economically
Red believes its national interests will not be compromised
Red decides to negotiate end of conflict
Blue NCA speech offers cooperation if Red withdraws
Red believes post conflict relationship with Blue will be set
Red recognizes Blue has not degraded Red nuke capability
Red believes Blue will strike massively if Nucs are used
Red decides to use Nuclear option
Blue NCA pledges not to use nukes first
Red believes use of strat nucs is counterproductive
Blue Press reports major demonstrations against war
Blue forces are in position to strike Red Nuc capability
Red believes use of Nuke will push Blue to negotiate

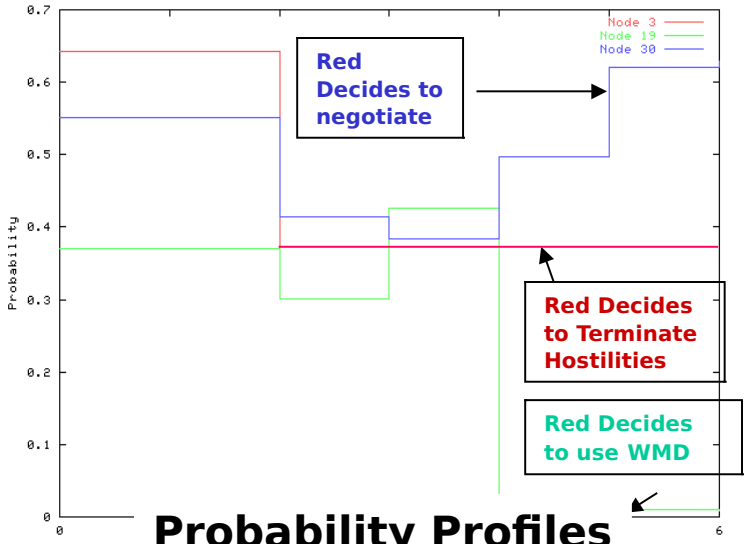
Influence Net

Indicator

EXECUTABLE MODEL

COAs (actions/ times)





Probability Profiles

GMU
George Mason

SDT: ATD vs. Objective System

Anticipated Capabilities

- Limited coverage of strategies, JFC/JFACC missions; Limited IW
- Limited COG/TS analysis; no Mission Analysis/Situation Development
- No COA analysis/comparison capability
- No JAOP development support past COA option development
- No CS (e.g., Logistics, Mobility), TACS, or Space considerations/Risk Analysis

Required Capabilities

- Covers all strategy options
- Covers all JFC missions (e.g., HUMRO, PK/PE, etc.)
- Covers all JFACC missions (e.g., CA, SA, CL, etc.)
- Incorporates lethal/nonlethal, kinetic/non-kinetic applications of force
- Supports Joint Air Estimate Process through JAOP development (JP 3-30)
- Supports JFACC Daily Guidance planning (JP 3-30)

CAT: ATD vs. Objective System

Anticipated Capabilities

- Outcome assessment at Force and Campaign levels
- Limited ability to incorporate evidence
- Complete drilldown, predictive and reconstructive assessment
- Value-of-information ISO collection management and branch planning

Required Capabilities

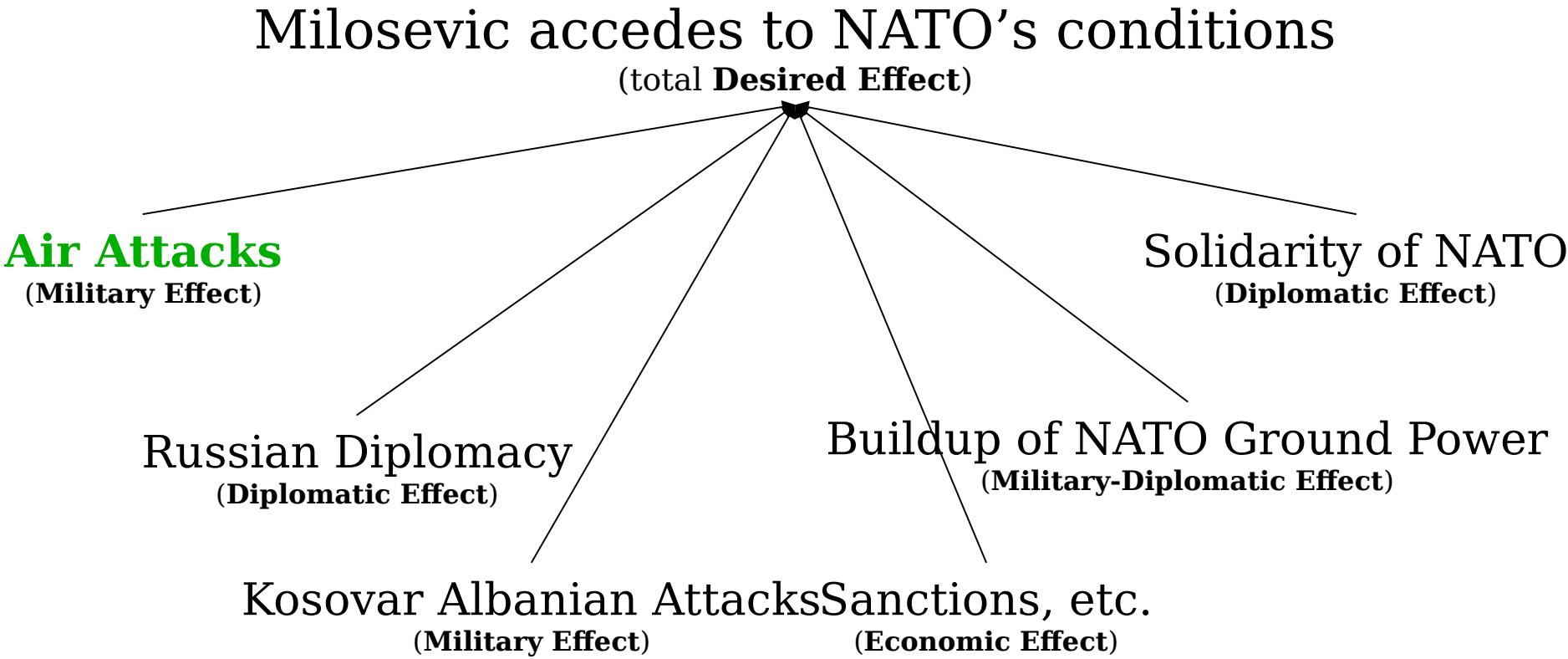
- Predictive assessment ISO COA development
- Assessment of outcomes ISO Engagement, Battle, Force and Campaign execution
- Reconstructive assessment of outcomes ISO plan refinement
- Incorporation of all-source information
- Drilldown to action, causes, and mechanism level

Summary

- **Definitional issue only a start**
  - **No approved dictionary let alone glossary or encyclopedia**
- **Ontology common to all applications**
  - **A common task but a common ontology server**
  - **Basis for library**
- **Not just EBO: IPB (Fusion), JBI, IW, TUT, TST, etc.**
- **Shared language essential to shared understanding**
  - **Shared understanding alone insufficient**

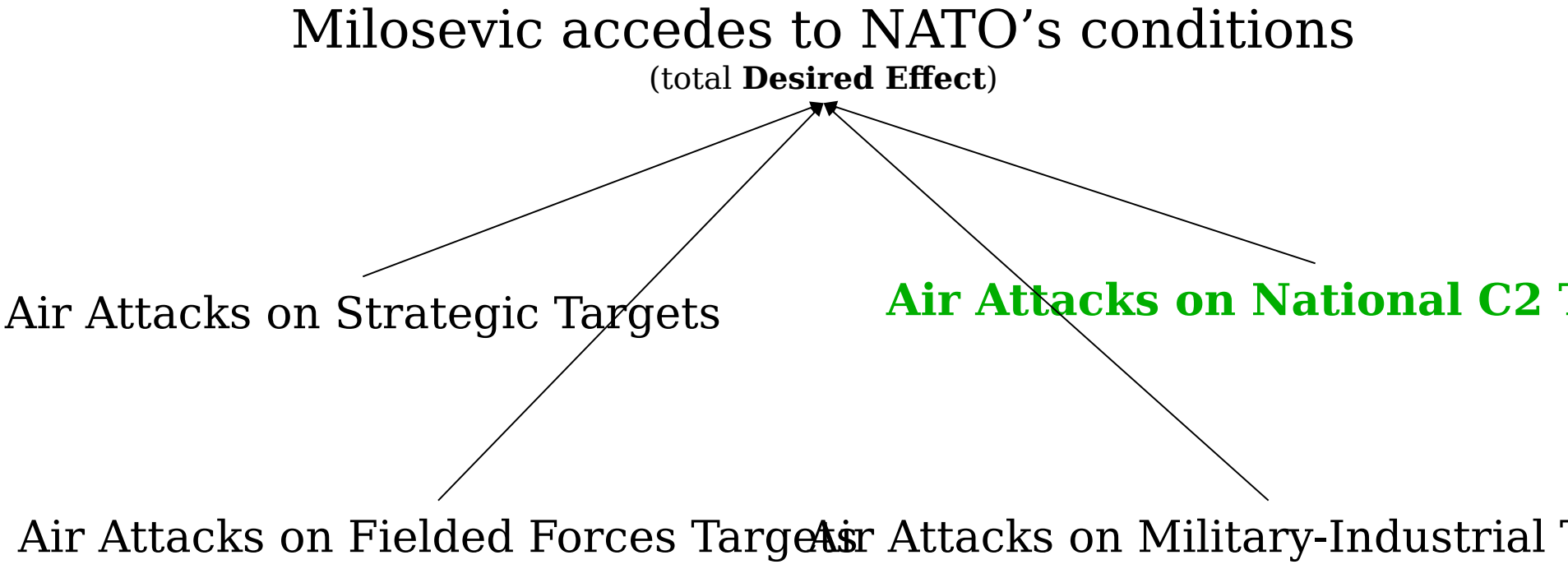
Operation ALLIED FORCE

Operation Allied Force EBO Example (1)
(from DOD AAR)



Expanded on Next Slide

Operation Allied Force EBO Example (2)
(from DOD AAR)


Milosevic accedes to NATO's conditions
(total **Desired Effect**)
Air Attacks on Strategic Targets
Air Attacks on National C2
Air Attacks on Fielded Forces Targets
Air Attacks on Military-Industrial

Expanded on Next Slide

Operation Allied Force EBO Example (3)
(from DOD AAR)